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NATIONAL DAM SAFETY PROGRAM. LAKE STOCKHOLM DAM (NJ 00302), PAS--ETC(U)
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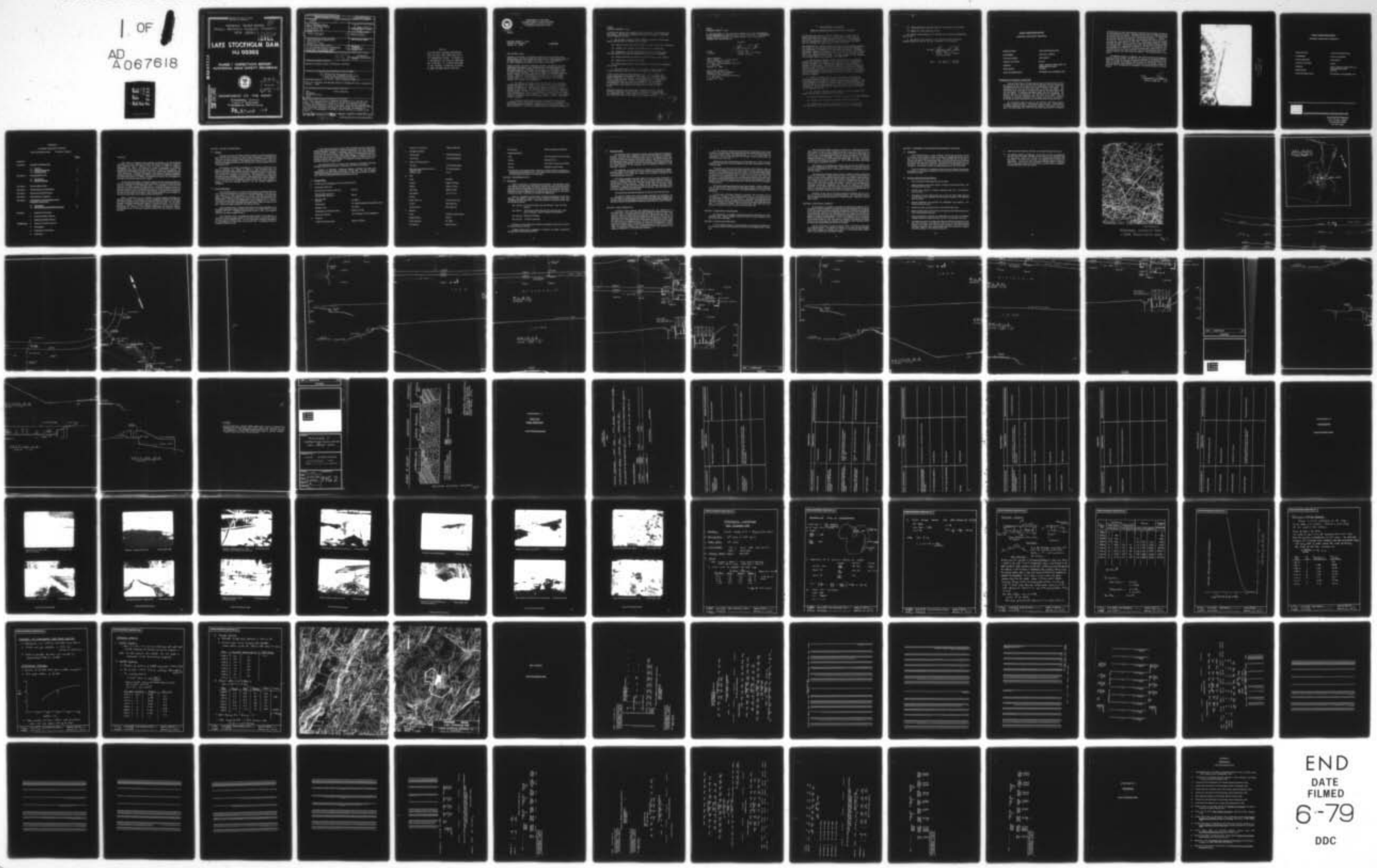

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PASSAIC RIVER BASIN
SMALL BRANCH, PASSAIC COUNTY
NEW JERSEY

LEVEL II

LAKE STOCKHOLM DAM
NJ 00302

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

March, 1979

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
Embankments
Structural Analysis
Safety
Visual Inspection

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

10 APR 1979

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Lake Stockholm Dam in Sussex County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Lake Stockholm Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in poor overall condition. The dam's spillway is considered inadequate since 42 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood). To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within six months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability. This should include test borings to determine material properties relative to

NAPEN-D
Honorable Brendan T. Byrne

stability and seepage and installation of piezometers to facilitate seepage studies. Any remedial measures found necessary should be initiated within calendar year 1980.

c. The following remedial actions should be completed within three months from the date of approval of this report:

(1) Repair upstream areas where riprap is missing or has been destroyed.

(2) Provide clear channel for spillway discharge under road.

(3) Investigate and clear downstream end of the low level outlet pipe and provide trash rack at upstream end of the pipe if necessary.

(4) Remove flashboard and provisions for flashboards from spillway.

(5) Remove all trees from area of dam.

(6) Repair eroded areas at left abutment and upstream and downstream face of dam.

d. The deteriorated concrete in the spillway sidewall should be repaired within one year of the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman James A. Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-D
Honorable Brendan T. Byrne

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

1 Incl
As stated

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

Copies furnished:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N. J. Dept. of Environmental Protection
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Trenton, NJ 08625

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LAKE STOCKHOLM DAM (NJ00302)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 9 and 29 November and 2 December 1978 by Langan Engineering Associates, Inc. under contract to the State of New Jersey. The state, under agreement with the U. S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92367.

Lake Stockholm Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in poor overall condition. The dam's spillway is considered inadequate since 42 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood). To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within six months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability. This should include test borings to determine material properties relative to stability and seepage and installation of piezometers to facilitate seepage studies. Any remedial measures found necessary should be initiated within calendar year 1980.

c. The following remedial actions should be completed within three months from the date of approval of this report:

(1) Repair upstream areas where riprap is missing or has been destroyed.

(2) Provide clear channel for spillway discharge under road.

(3) Investigate and clear downstream end of the low level outlet pipe and provide trash rack at upstream end of the pipe if necessary.

(4) Remove flashboard and provisions for flashboards from spillway.

(5) Remove all trees from area of dam.

(6) Repair eroded areas at left abutment and upstream and downstream face of dam.

d. The deteriorated concrete in the spillway sidewall should be repaired within one year of the date of approval of this report.

APPROVED: James G. Ton
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 10 April 1979

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	LAKE STOCKHOLM DAM
ID NUMBER:	FED ID No. NJ00302
STATE LOCATED:	NEW JERSEY
COUNTY LOCATED:	SUSSEX
STREAM:	SMALL BRANCH-TRIBUTARY TO PEQUANNOCK RIVER
RIVER BASIN:	PASSAIC
DATE OF INSPECTION:	NOVEMBER and DECEMBER 1978

ASSESSMENT OF GENERAL CONDITIONS

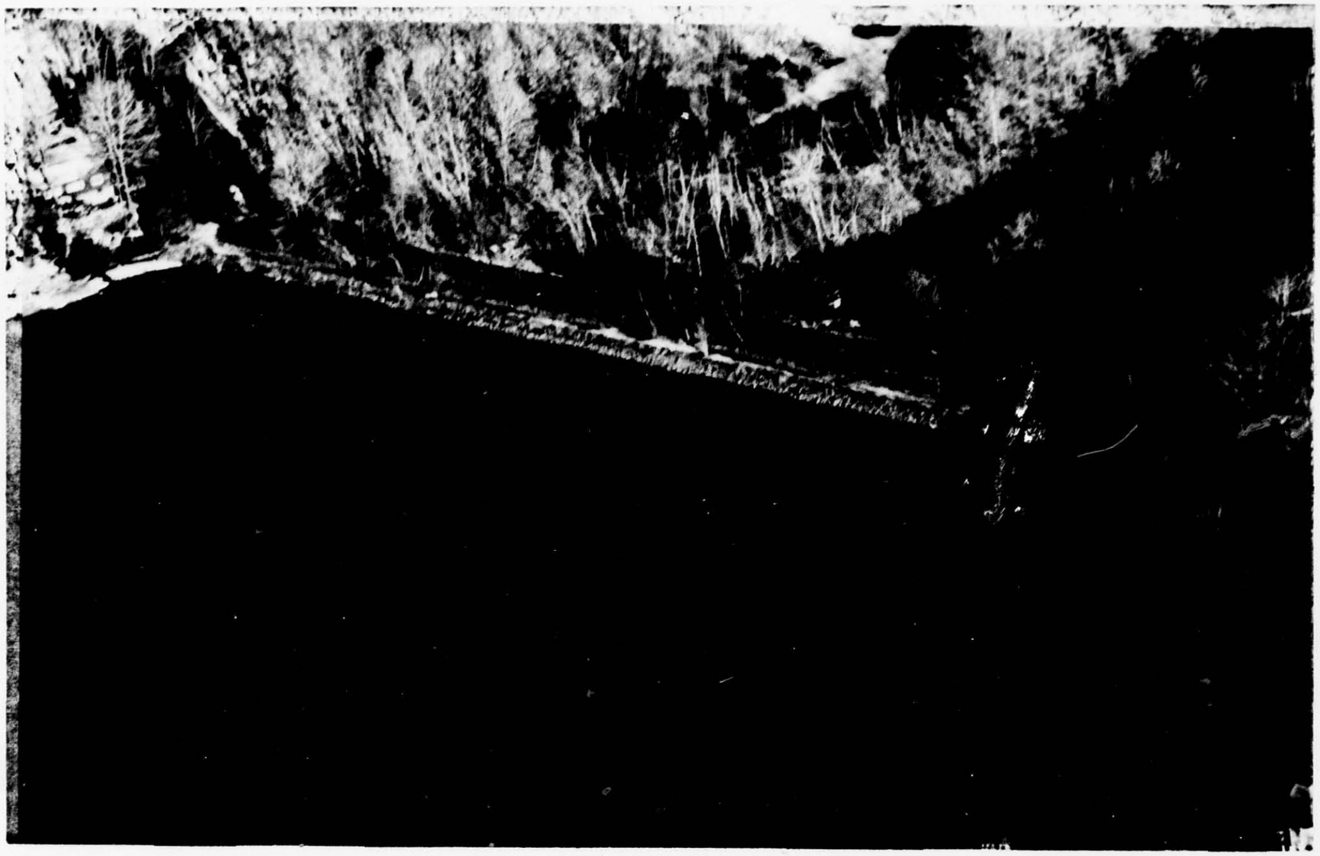
Lake Stockholm Dam is 50 years old and in poor overall condition. Erosion has occurred at the top of the dam and the upstream riprap is missing over considerable portions of the dam and has deteriorated in other areas. The discharge end of the low level outlet pipe is covered with debris. The downstream slope of the dam is covered with trees and the downstream area is wet and spongy. The spillway discharge channel has trees and debris. The spillway capacity as determined by CE Screening criteria is inadequate. We estimate the dam can adequately pass only 21% of the PMF. There is essentially no available information on the design, construction, and operation of the dam and there is uncertainty as to the future performance of the dam.

We recommend repair be made to the upstream areas where riprap is missing or has been destroyed. This should be done very soon. A clear channel for spillway discharge under road should be provided. This sould be done very soon. The downstream end of the low level outlet pipe should be investigated and cleared and a trash rack provided at upstream end of the pipe if necessary. This should be done very soon. Flashboard and provisions for flashboards should be removed from the spillway. This should be done very soon. All trees should be removed from the area of the dam. This should be done soon. Eroded areas at left abutment and upstream and downstream faces of the dam should be repaired. This should be done soon. Piezometers should be installed upstream and downstream of the dam to determine seepage conditions through and under the dam. This should be done soon. Borings and tests should be used to investigate the engineering properties of the dam and foundation, and, determinations as to whether or not conventional safety margins exist and modifications that may be required should be made. This should be done soon. The concrete spillway side wall should be repaired. This should be done in the future.

The spillway capacity is inadequate. We estimate the dam can adequately pass only 21% of the PMF. The SDF and the capacity of the spillway should be determined using more precise and sophisticated methods and procedures. The need for and type of mitigating measures should be determined. Around the clock surveillance during periods of unusually heavy precipitation should be provided, and a warning system established. This should be done in the near future.

Dennis J. Leary

Dennis J. Leary, P.E.



OVERVIEW
LAKE STOCKHOLM DAM
1 DECEMBER 1978

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	LAKE STOCKHOLM DAM
ID NUMBER:	FED ID No. NJ00302
STATE LOCATED:	NEW JERSEY
COUNTY LOCATED:	SUSSEX
STREAM:	SMALL BRANCH-TRIBUTARY TO PEQUANNOCK RIVER
RIVER BASIN:	PASSAIC
DATE OF INSPECTION:	NOVEMBER and DECEMBER 1978

LANGAN ENGINEERING ASSOCIATES, INC.

Consulting Civil Engineers

990 CLIFTON AVENUE

CLIFTON, NEW JERSEY

201-472-9366

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NATIONAL DAM SAFETY REPORT

LAKE STOCKHOLM DAM FED ID No NJ00302

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

SECTION 1 PROJECT INFORMATION

1.2 General

Authority to perform the Phase I Safety Inspection of Lake Stockholm Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 20 November 1978. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the U.S. Army Engineer District, Philadelphia, Penn.

The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to safety of Lake Stockholm Dam and appurtenances based upon available data and visual inspection, and determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted. The assessment is made using screening criteria established in Recommended Guidelines for Safety Inspection of Dams prepared by the Department of Army, Office of the Chief of Engineers. It is not the purpose of the inspection report to imply that a dam meeting or failing to meet the screening criteria, is per se, certainly adequate or inadequate.

1.2 Project Description

Lake Stockholm Dam is a 50 year old 630-ft-long, 16-ft-high earthfill dam with a concrete corewall and a concrete notch overfall spillway. The dam has a crest width of 8 ft and 2 horizontal to 1 vertical upstream and downstream slopes. The spillway weir length is 30 ft and located at the right abutment of the earthfill dam. The top of the spillway weir is 2 ft below the crest of the dam. The spillway has provisions for flashboards to reduce freeboard to 1 ft. There is a 12-in-dia C.I. low level outlet pipe with a gate valve at about the center of the dam. Access is through a manhole on the crest of the dam.

Lake Stockholm Dam is located at the north end of Lake Stockholm in the Township of Hardyston, Sussex County, New Jersey. It is at latitude 41° 4.3' and longitude 74° 31.7'. A regional vicinity map is given in Fig. 1 and essential features of the dam are given in Fig. 2.

Lake Stockholm Dam is classified as being "Small" on the basis of its maximum reservoir storage volume of 335 ac-ft, which is more than 50-acre feet, but less than 1000-acre feet. It is also classified as "Small" on the basis of its total height of 16 feet, which is less than 40 feet. Accordingly the dam is classified as "Small" in size.

In the National Inventory of Dams, Lake Stockholm has been classified as having "High Hazard Potential" on the basis that failure of the dam would cause excessive property damage to residences downstream, and could potentially cause more than a few deaths. Visual inspection of the downstream area shows that breach of the dam would cause little damage to residences which are located on high ground but could be hazardous to people utilizing the low lying Stockholm Terrace road. Accordingly, it is proposed to change the Hazard Classification Potential to "Significant".

Lake Stockholm Dam is owned by the Township of Hardyston, Municipal Building, Stockholm, New Jersey. The purpose of the dam is recreation.

William H. Boardman, Consulting Engineer prepared the plans and specifications and supervised construction of the dam. The John W. Heller Construction Company constructed the dam in 1928. No information is available after 1928 concerning operational procedures for the dam.

1.3 Pertinent Data

a. At dam site, the drainage area is 415 acres (0.65 sq mi)

b. Discharge at Dam Site

Maximum known flood at dam site:	Unknown
Total spillway capacity at maximum pool elevation:	303 cfs

c. Elevation *(ft)

Top dam:	El. 1098.4
Normal pool:	El. 1096.2 (Assumed to be spillway crest)
Spillway crest:	El. 1096.2
Streambed at centerline of dam:	Approx. El. 1082
Maximum tailwater:	No discharge at time of inspection.

d. Reservoir

Length of maximum pool:	Approx. 2100 feet

	Length of normal pool:	Approx. 2000 feet
e.	Storage (acre-feet)	
	Normal pool:	300 AF (estimated)
	Top of dam:	335 AF (estimated)
f.	Reservoir Surface (acres)	
	Top dam:	34.5 AF (estimated)
	Recreation pool (assumed to be at spillway crest):	33 AF (estimated)
	Spillway crest:	33 AF
g.	Dam	
	Type:	Earthfill
	Length:	Approx. 630 feet
	Height:	Approx. 16 feet
	Top width:	Approx. 8 feet
	Side Slopes:	2 hor to 1 vert
	Zoning:	
	Impervious core:	Concrete core wall
	Cutoff:	None observed
	Grout Curtain:	None observed
h.	Spillway	
	Type:	Concrete notch overfall
	Length of Weir:	30 feet
	Crest elevation:	El. 1096.2
	U/S channel:	None observed

D/S channel:	Steep rock slope with boulders

i. Regulating Outlets

Type:	Low level outlet 12-in-dia CI pipe
Length:	Estimate 100 ft
Closure:	Gate valve at bottom of manhole
Access:	Manhole on crest of dam

*All elevations were obtained from a field survey using a reference elevation of 1100.00 at an assumed bench mark. The reference elevation was estimated from the USGS Map for Franklin, N.J. Quadrangle.

SECTION 2 ENGINEERING DATA

2.1 Introduction

There is essentially no engineering data available. Correspondence dated 1928 indicates the top of the core wall is 1 ft below the crest of the dam and the core wall was carried to ledge rock at both abutments of the dam and wood sheet piling was driven to ledge rock or hard pan between the abutments. The dam is reported to have been designed for a maximum high water level one foot below the top of the dam. Lake level is controlled with flashboards.

There is essentially no information concerning construction of the dam. However, the engineer stated in a letter dated 20 September 1928, "The Contractor did their work well". This letter also gives the results of preliminary test borings as follows:

Sta. 1 plus 95	2' - 6" muck,7'6 blue clay, and 9'0 sand. Total 19' to hard bottom.
Sta. 3 plus 0	2'-6" muck,7 ft blue clay, and 10'-6 sand and clay. Total 20 ft to hard pan. 22.5 ft to ledge rock or boulders.
Sta. 4 plus 62	16½ feet to hard pan.
Sta. 5 plus 25	11½ feet to hard pan.

Operation of the outlet works consists of opening the gate valve to lower the lake each year in the fall.

Available information is inadequate to evaluate the design, construction and operation of Lake Stockholm Dam.

2.1 Regional Geology

Lake Stockholm Dam is located in the New Jersey Highlands physiographic province. The New Jersey Highlands extend across the state in a northeast-southwest direction from the border of New York to the Delaware River and includes the northwest portions of Hunterdon, Passaic, and Morris Counties and the southeastern parts of Warren and Sussex Counties. This province is part of the New England Physiographic Province and lies between the Appalachian Ridge and Valley Province to the northwest and the Piedmont Province to the southeast. See Fig 3.

The Highlands are characterized by rounded and flattopped northeast-southwest ridges and mountains up to 1,400 ft high separated by narrow valleys. The orientation of the valleys are usually, but not always controlled by the underlying geologic structure.

The regional geologic structure reflects the very old age of bedrock. A number of regional faults cross the area in a northeast southwest direction, including the Ramapo Fault; the more than 30 mile long fault scarp forms the eastern border of the province. Faults control many of the river valley orientations. The relatively uniform slope of the mountain elevations, from northwest to southeast, is a direct result of the faulting. The entire area is part of the now dissected Schooley Peneplain.

The Pleistocene Age Wisconsin glacier covered all of the dam site area.

The glacier stripped most of the existing overburden and weathered rock and uncovered the numerous hard bedrock knobs and ridges seen throughout the province. Most of the side-slopes in the area are covered with heavy boulder tills (ground moraine), whereas glacial outwash and recent alluvium cover the valleys.

SECTION 3 VISUAL INSPECTION

Available records indicate Lake Stockholm Dam was inspected on 21 September 1928. The report indicates slight seepage all along the downstream toe with water carrying typical iron scum and a very small total flow. The inspector stated in a letter dated 28 September 1928 "We find that the dam is apparently well constructed and safe insofar as the foundation is concerned. We did, however, find that flashboards had been placed in the spillway, which raised the water level to a dangerous extent. We have communicated with the owner and with this engineer and are ordering the removal of the flashboards". Another inspection and what appears to be the last inspection was made on 30 October 1928. The inspection report states, "Flashboards which were observed in the spillway on September 21, 1928 have been removed."

Our site inspection disclosed the earthfill dam embankment to be in poor condition. Several areas on the downstream face have eroded and portions of the top of the upstream slope has eroded leaving a 1 to 1.5 ft scarp along the embankment. The crest has sags from 4 to 6 inches. Trees and brush cover the downstream face of the dam.

Riprap exists only along portions of the upstream face. There is erosion along the right abutment from what appears to have been overtopping of the dam at this location.

The spillway is constructed of concrete and has a 30-ft long weir crest and appears to be founded on rock at the right abutment and has a concrete sidewall abutment at the embankment portion of the dam. A steel framed wooden bridge crosses the spillway and wooden platform extends out into the reservoir where the spillway and embankment abut. Erosion has occurred from under the platform. A concrete pad appears to have been poured relatively recently under the platform and erosion has occurred in an area about 6 inches deep by 2 ft wide along the west side of the spillway side wall. The side wall concrete has spalled and deteriorated.

The spillway discharge channel contains trees and debris. Debris, brush and trees are also present in the downstream discharge channel. No clear discharge channel exists to the roadway culvert. The area downstream of the dam is wet and spongy.

An 8.5-ft-dia, 25-ft-deep manhole is located in the mid portion of the embankment. It houses a T-stem operated gate valve to a low level 12-in-dia C.I. outlet pipe for lowering of the reservoir. The manhole contains debris and about three feet of water. The gate valve is functional. The discharge end of the pipe is between the road (Stockholm Terrace) and the downstream toe of the dam. It is covered with debris. With the gate open, water flows out of the ground at the location of the 15-in-dia culvert under the road.

SECTION 4 OPERATIONAL PROCEDURES

No information is available concerning operational procedures for Lake Stockholm Dam. Nearby residents reported the lake is lowered annually in the fall of the year to kill algae.

SECTION 5 HYDRAULIC/HYDROLOGIC

A local resident informed us the downstream road has been inundated five or six times in the last ten years and that the dam was overtopped about 12 years ago.

The hydraulic/hydrologic evaluation is based on a Spillway Design Flood (SDF) equal to half of the Probable Maximum Flood (1/2 PMF) chosen in accordance with the evaluation guidelines for dams classified as Significant and Small in size. Hydrologic design data for this dam is not available. The PMF has been determined by developing a synthetic hydrograph based on the maximum probable precipitation of 22.0 inches (200 square mile - 24 hour). Hydrologic computations are presented in Appendix 4. The 1/2 PMF peak inflow determined for the subject watershed is 1971 cfs.

The capacity of the spillway at maximum pool elevation (El. 1098.4) is 303 cfs which is significantly less than SDF. Flood routing for the 1/2 PMF indicates the dam will overtop by 0.8 ft. We estimate the dam can adequately pass only 21% of the PMF.

The downstream potential damage center is a lightly travelled road located at the toe of the dam. Beyond this road there is a relatively wide (1000± ft) valley with the first dwelling encountered approximately 2000 ft downstream and at an elevation 40± ft above the valley bottom. Overtopping of the dam under the 1/2 SDF will result in water flow across the roadway since there is only a small culvert (30") located under the roadway. Based on our knowledge of the immediate downstream topography, the dam and the degree of overtopping potential it is our opinion that dam failure resulting from overtopping would not result in a significant increase in the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

Drawdown of the reservoir has been evaluated considering that the 12 in-dia C.I. low level outlet pipe is functioning properly . Our calculations indicate that the lake level could be lowered 4 ft in approximately 12 days and 12 feet in about 43 days.

SECTION 6 STRUCTURAL STABILITY

No information is available concerning the engineering properties of the foundation and dam materials. Consequently, analytical analyses of the stability of the dam cannot be made without gross assumptions concerning the properties of the materials. Based on our visual observation and the fact the road along the downstream side also serves as a stabilizing berm, the stability of the dam with respect to sliding and slope stability is likely to be adequate under the conditions observed during our site inspection. In addition, the spillway section is reported to have been founded on rock. This section of the dam is also likely to be stable. However, the actual degree of stability under different stress conditions should be determined using present day state of art methods.

Lake Stockholm Dam is located in Seismic Zone 1 of the Seismic Zone Map of Contiguous States. The degree of stability of the dam and appurtenances under static loading are uncertain with respect to conventional safety margins and may be unstable under earthquake loading.

SECTION 7 ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Assessment

Lake Stockholm Dam is in poor condition. Erosion has occurred at the top of the dam and the upstream riprap is missing over considerable portions of the dam and has deteriorated in other areas. The discharge end of the pipe is covered with debris. The downstream slope of the dam is covered with trees and the downstream area is wet and spongy. The spillway discharge channel has trees and debris. The spillway capacity as determined by CE Screening criteria is inadequate. We estimate the dam can adequately pass only 21% of the PMF.

There is essentially no available information on the design, construction, and operation of the dam, consequently there is uncertainty as to the future performance of the dam.

7.2 Recommendations/Remedial Measures

We recommend the following measures be taken:

1. Repair upstream areas where riprap is missing or has been destroyed. This should be done very soon.

2. Provide clear channel for spillway discharge under road. This should be done very soon.

3. Investigate and clear downstream end of the low level outlet pipe and provide trash rack at upstream end of the pipe if necessary. This should be done very soon.

4. Remove flashboard and provisions for flashboards from spillway. This should be done very soon.

5. Remove all trees from area of dam. This should be done soon.

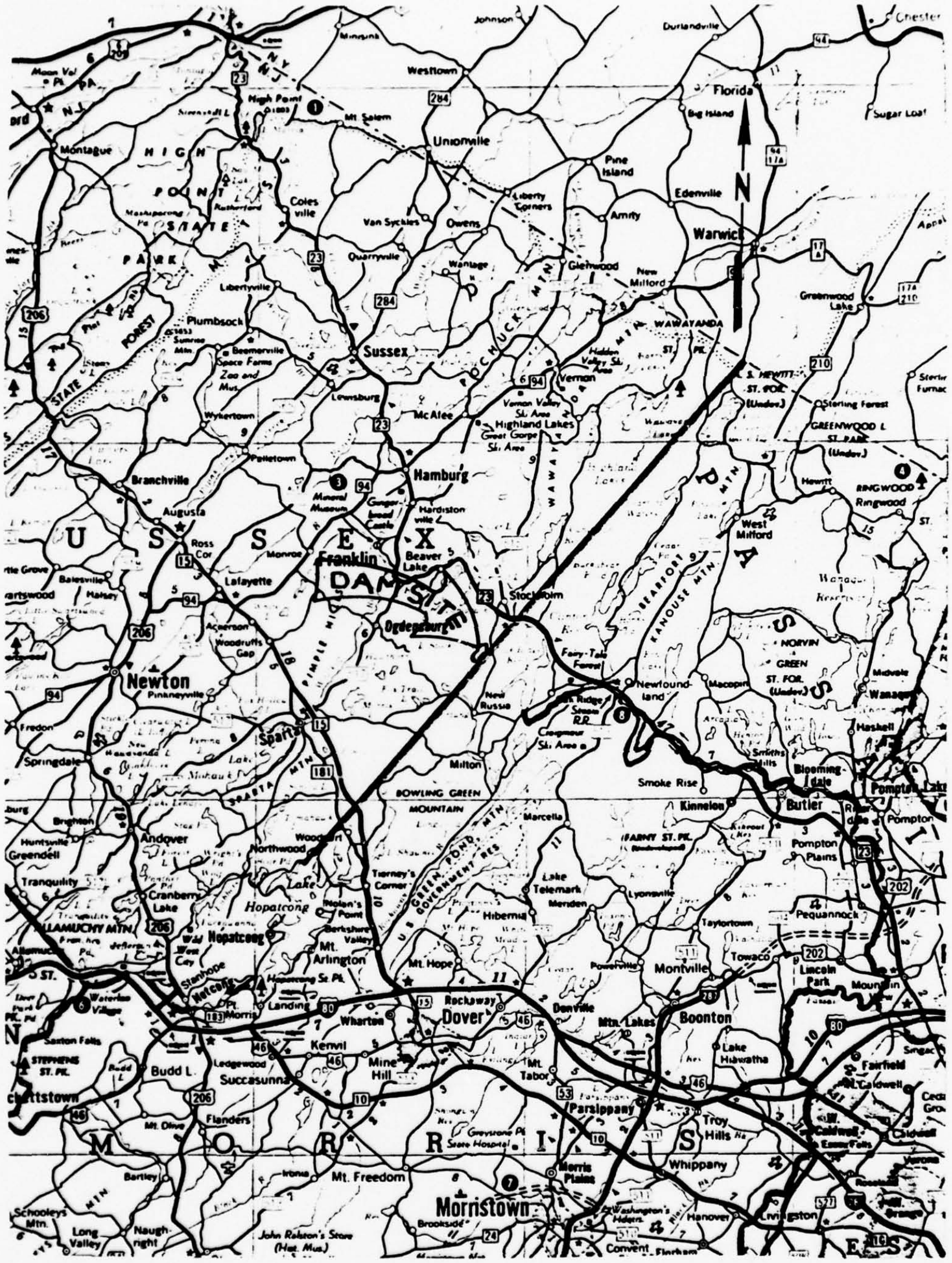
6. Repair eroded areas at left abutment and upstream and downstream face of dam. This should be done soon.

7. Install piezometers upstream and downstream of the dam to determine seepage conditions through and under the dam. This should be done soon.

8. Investigate by means of borings and tests, the engineering properties of the dam and foundation, and determine whether or not conventional safety margins exist under more severe stress conditions than those observed during our inspection, and, what modifications may be required to achieve such safety margins. This should be done soon.

9. Repair concrete of spillway side wall. This should be done in the future.

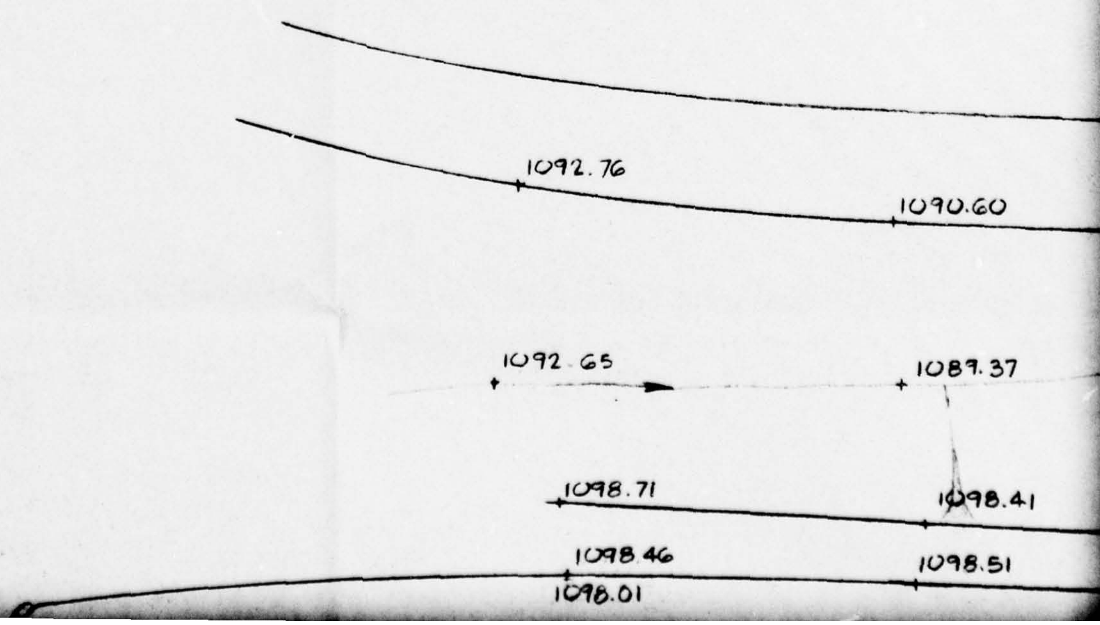
10. The spillway capacity is inadequate. We estimate the dam can adequately pass only 21% of the PMF. The SDF and the capacity of the spillway should be determined using more precise and sophisticated methods and procedures. The need for and type of mitigating measures should be determined. Around the clock surveillance during periods of unusually heavy precipitation should be provided, and a warning system established. This should be done in the near future.



lin ≈ 5.2mi

REGIONAL VICINITY MAP
LAKE STOCKHOLM DAM

Fig. 1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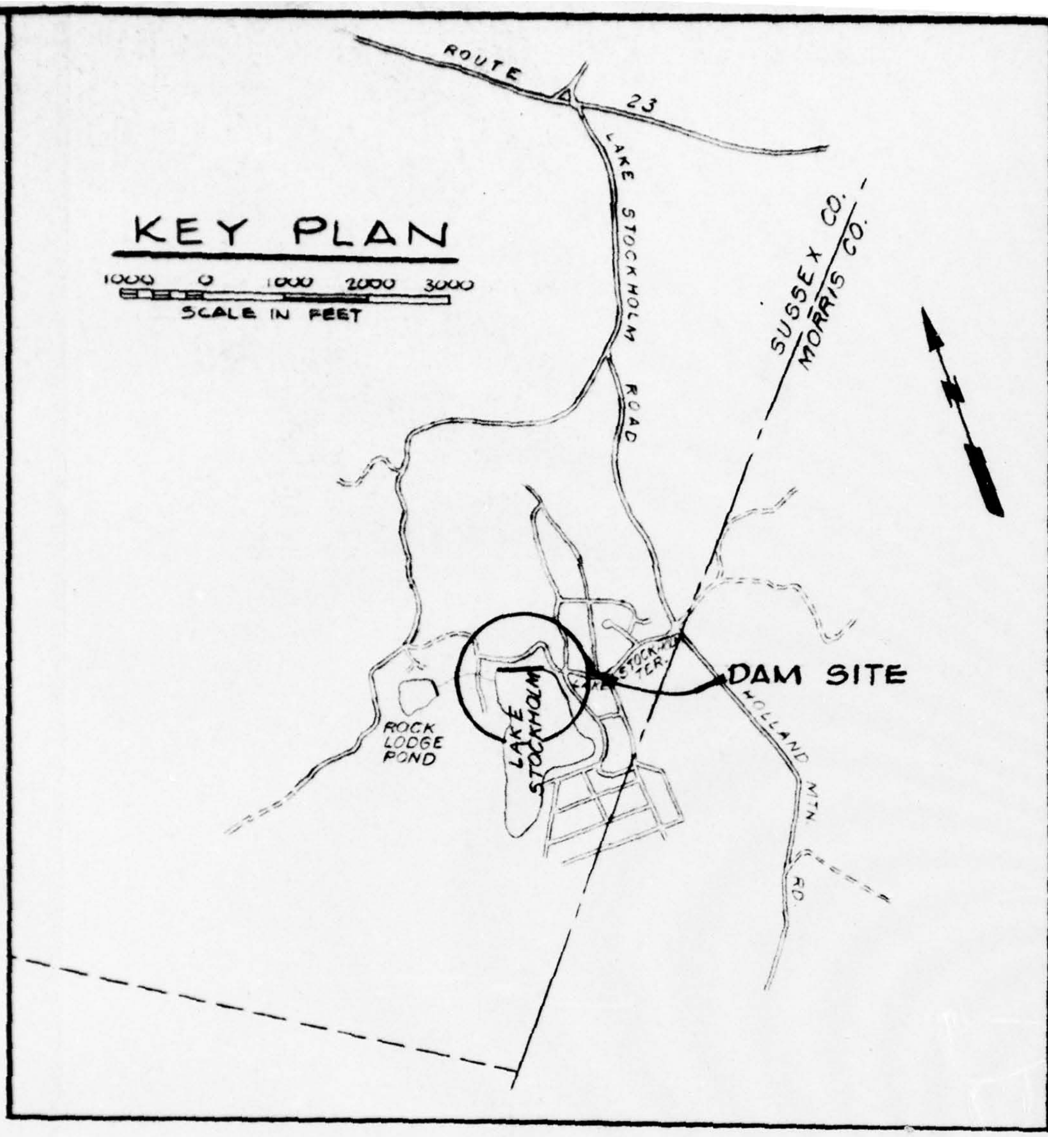
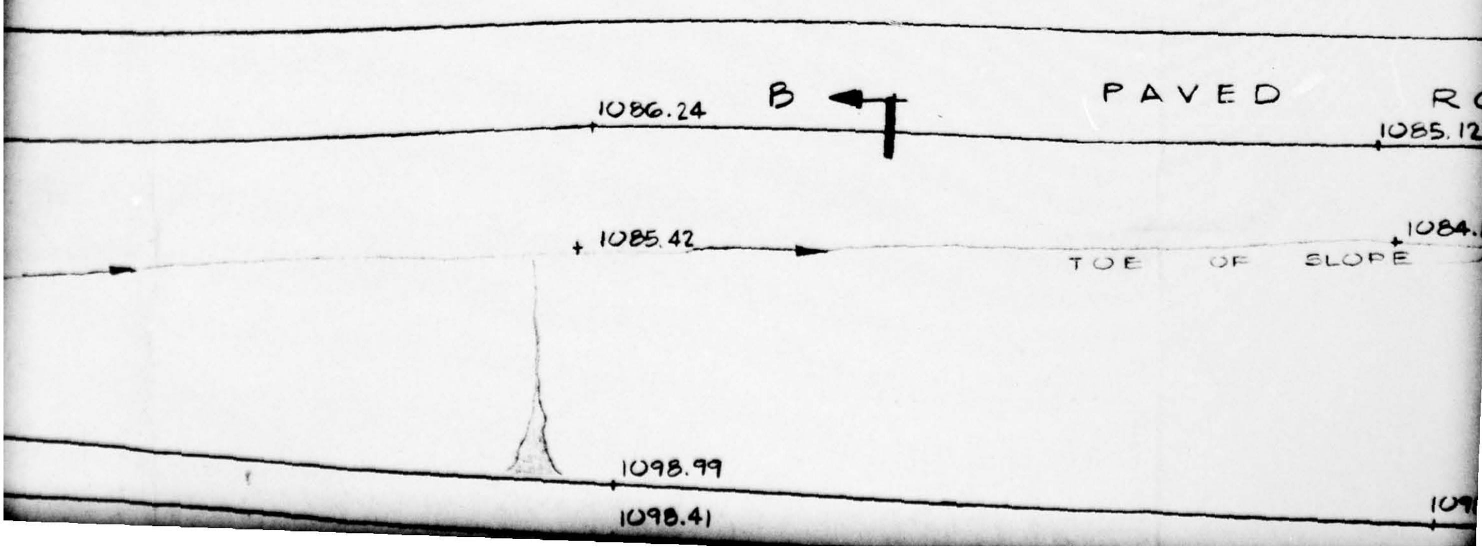
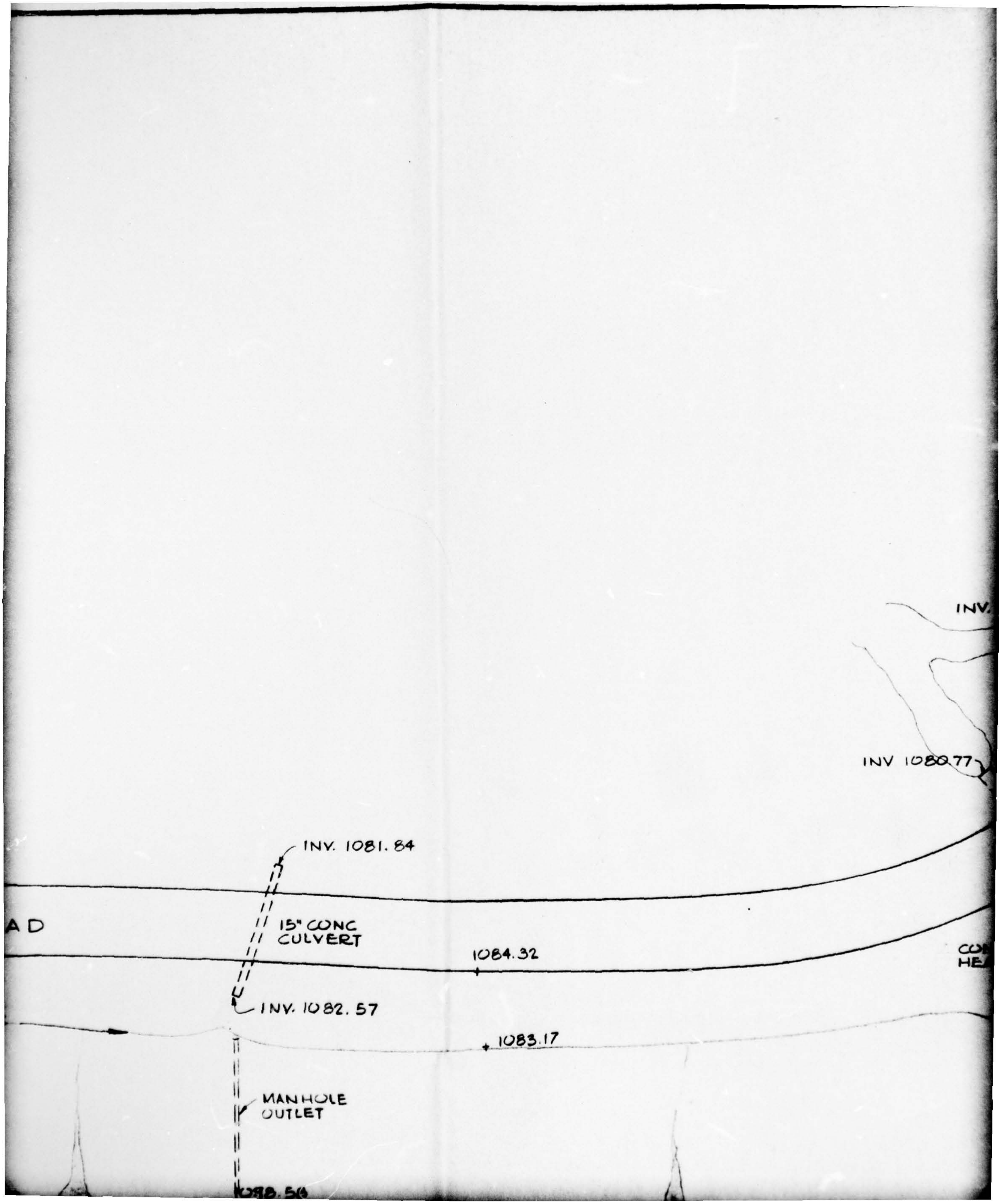
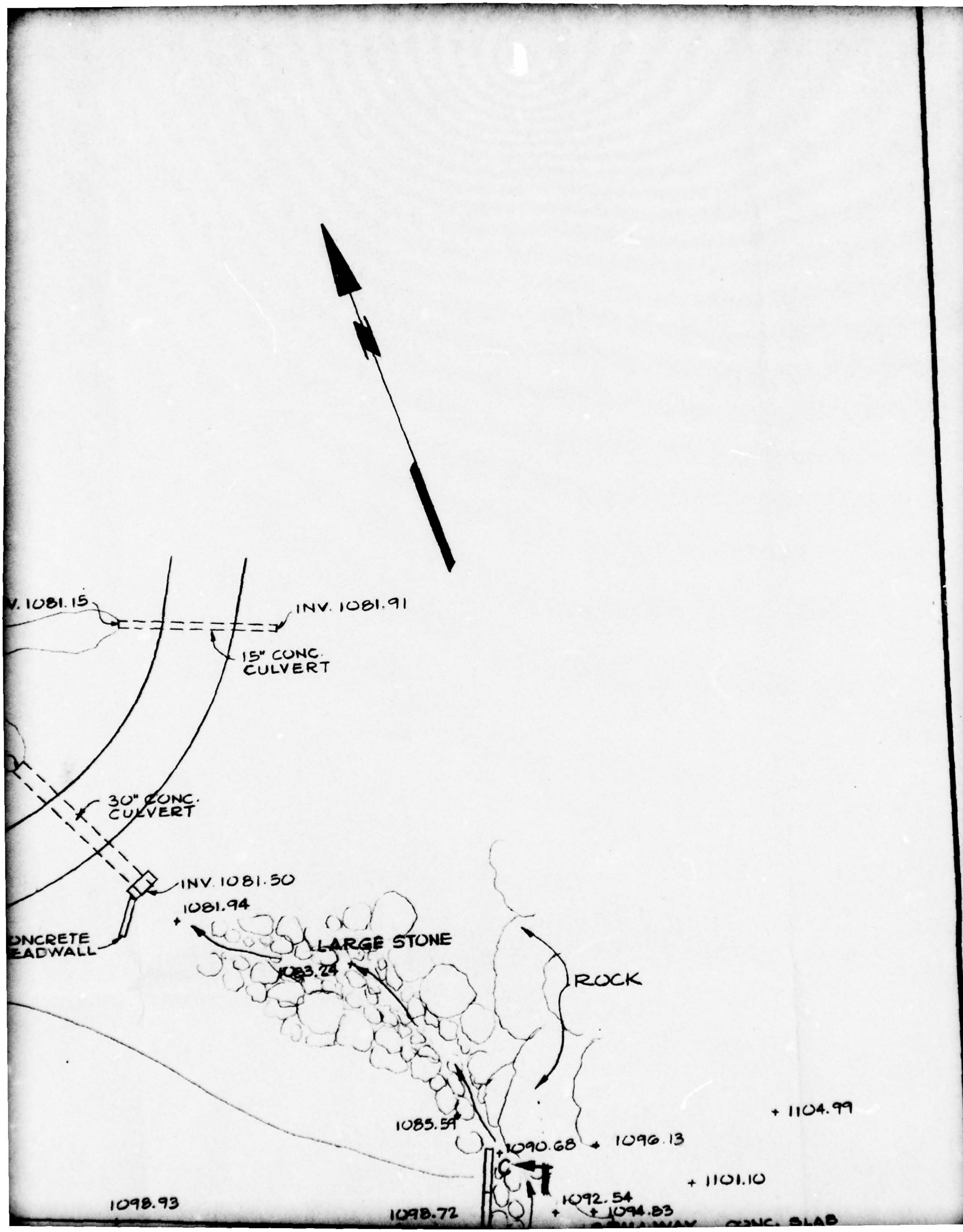
1090.60
1092.65
1089.37
1098.71
1098.41
1098.46
1098.51
1098.01


KEY PLAN
1000 0 1000 2000 3000
SCALE IN FEET
ROUTE 23
LAKE STOCKHOLM ROAD
SUSSEX CO.
MORRIS CO.
DAM SITE
ROCK LODGE POND
LAKE STOCKHOLM
HOLLAND MTN RD


B
PAVED
1086.24
1085.12
1085.42
TOE OF SLOPE
1098.99
1098.41

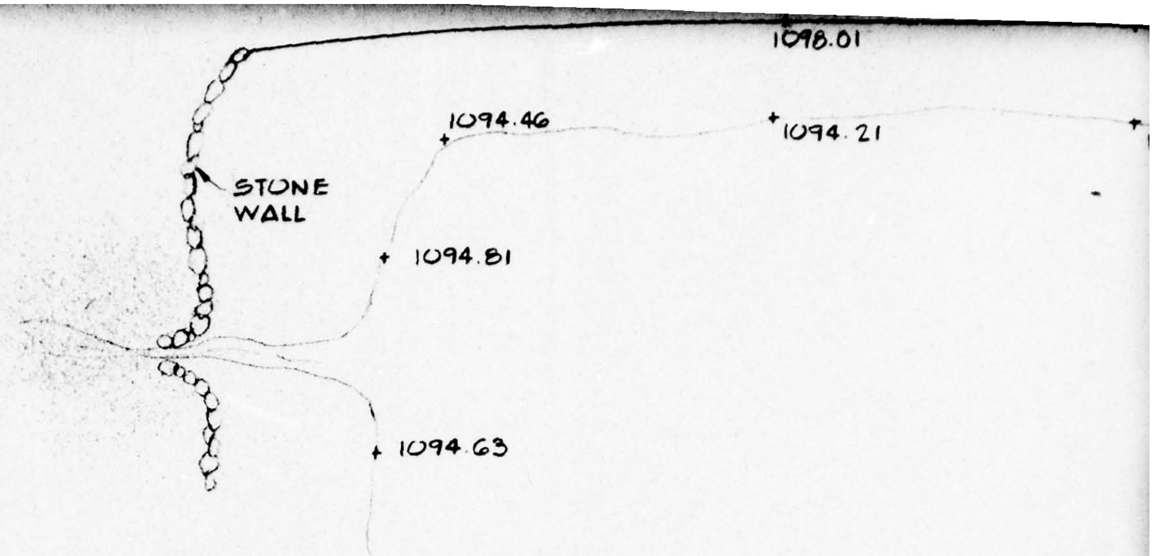

INV.
INV 1080.77
INV. 1081.84
AD
15" CONC
CULVERT
1084.32
CO
HE
INV. 1082.57
1083.17
MANHOLE
OUTLET
1078.50

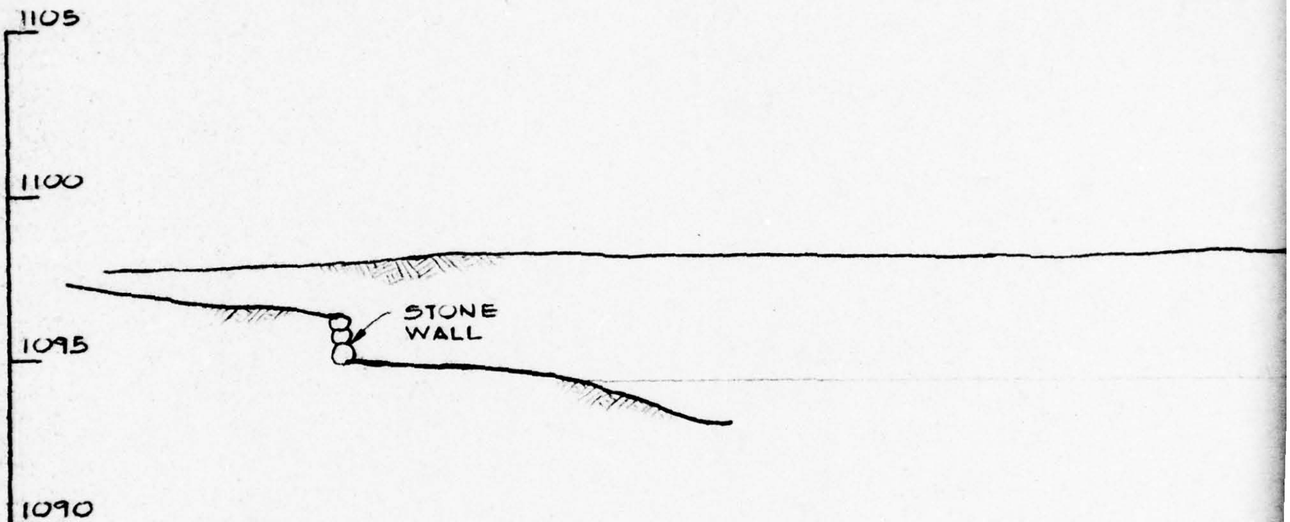


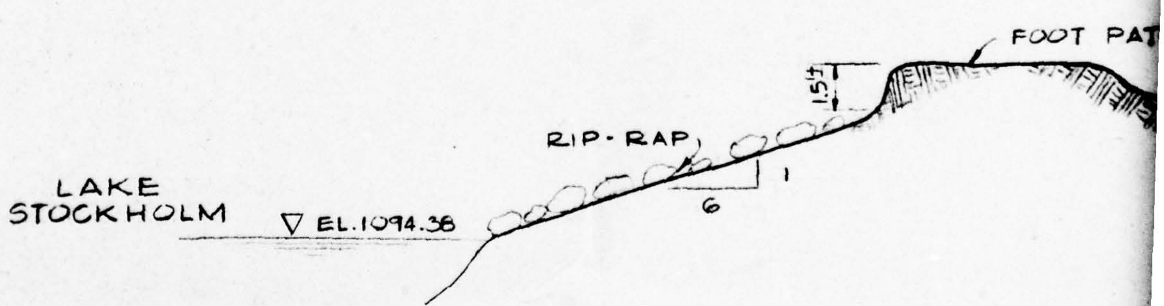
INV. 1081.15
INV. 1081.91
15" CONC. CULVERT
30" CONC. CULVERT
INV. 1081.50
1081.94
CONCRETE HEADWALL
LARGE STONE
1083.24
ROCK
1085.59
1090.68
1096.13
1104.99
1101.10
1098.93
1098.72
1092.54
1094.83
CONC. SLAB

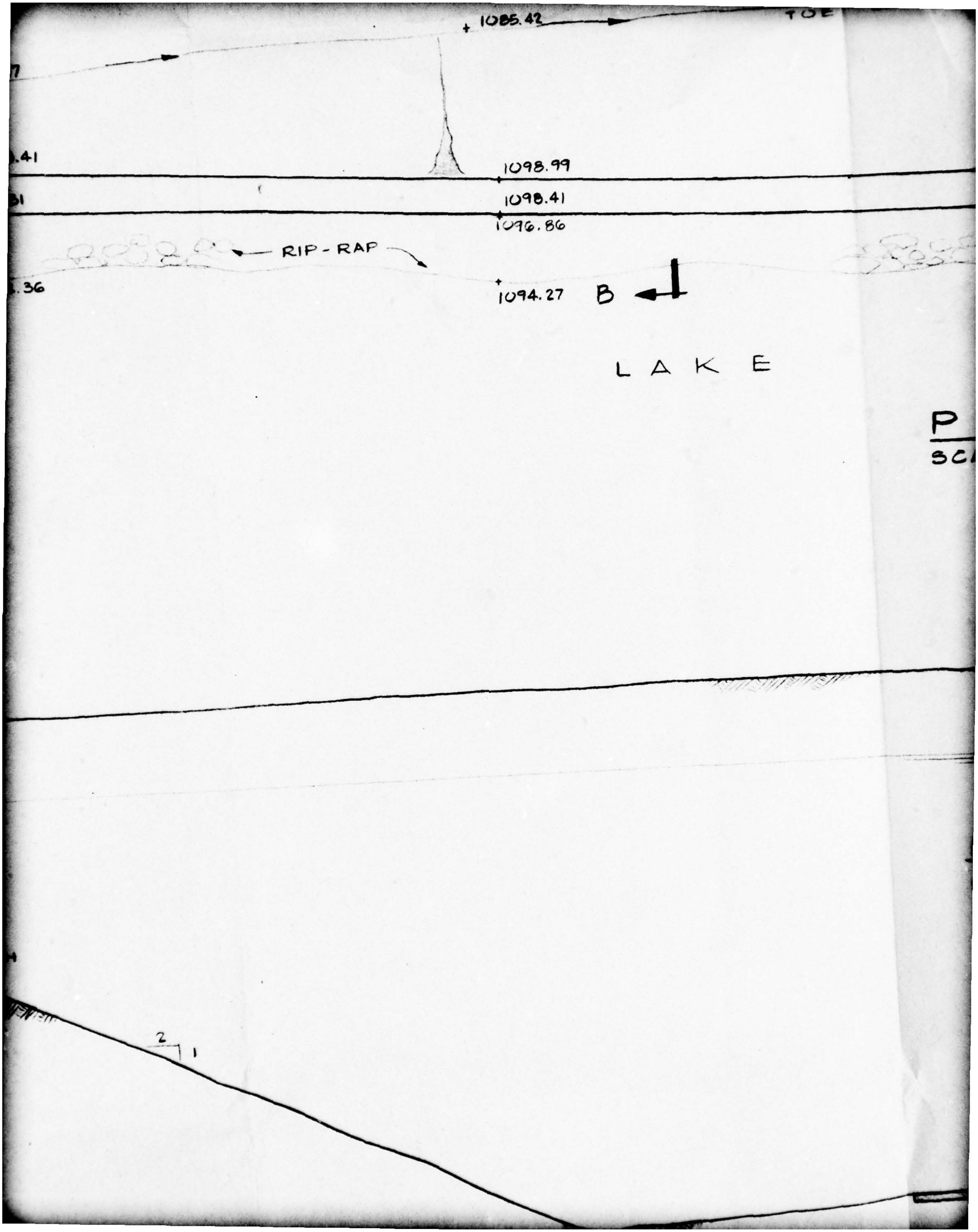
5

6

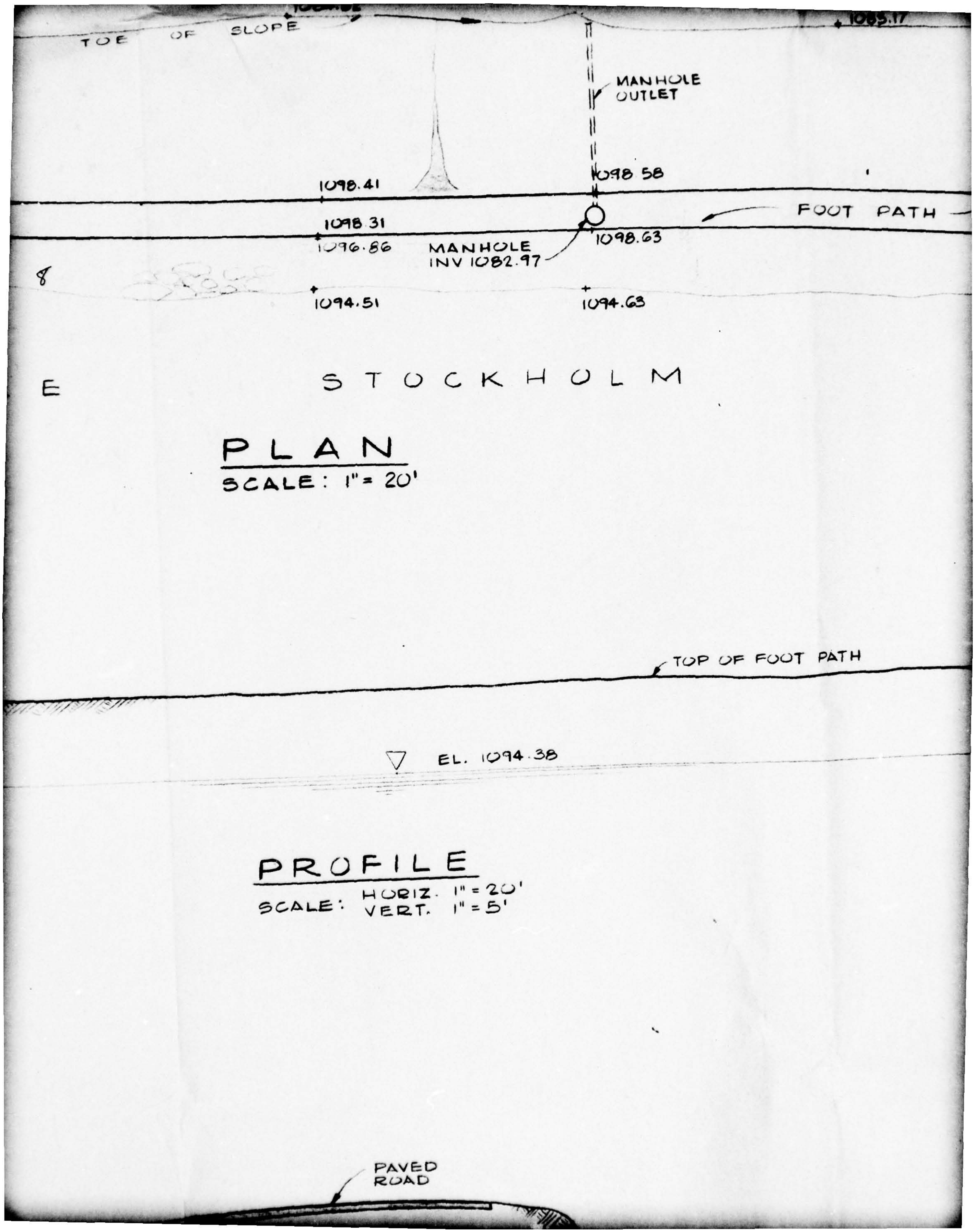

1098.01
1094.46
1094.21
STONE
WALL
1094.81
1094.63

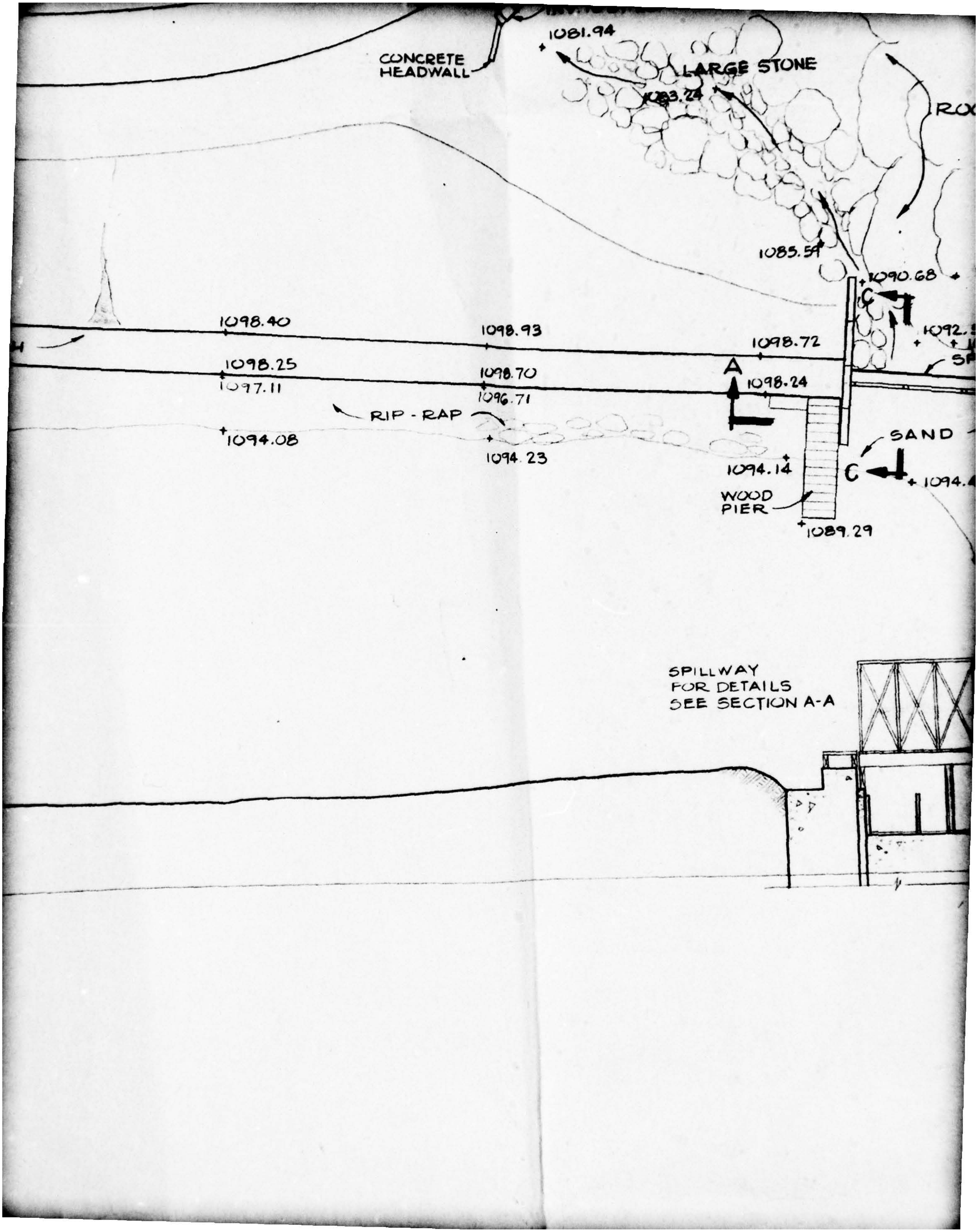

1105
1100
1095
1090
STONE
WALL


FOOT PAT
1.5±
RIP-RAP
1
6
LAKE
STOCKHOLM
▽ EL.1094.38



1085.42
TOE
.41
1098.99
31
1098.41
1096.86
RIP-RAP
.36
1094.27
B
LAKE
P
SC
2
1


TOE OF SLOPE
1085.17
MANHOLE
OUTLET
1098.41
1098.58
FOOT PATH
1098.31
1096.86
MANHOLE
INV 1082.97
1098.63
8
1094.51
1094.63
E
STOCKHOLM
PLAN
SCALE: 1" = 20'
TOP OF FOOT PATH
EL. 1094.38
PROFILE
SCALE: HORIZ. 1" = 20'
VERT. 1" = 5'
PAVED
ROAD



1081.94
CONCRETE HEADWALL
LARGE STONE
1083.24
1085.59
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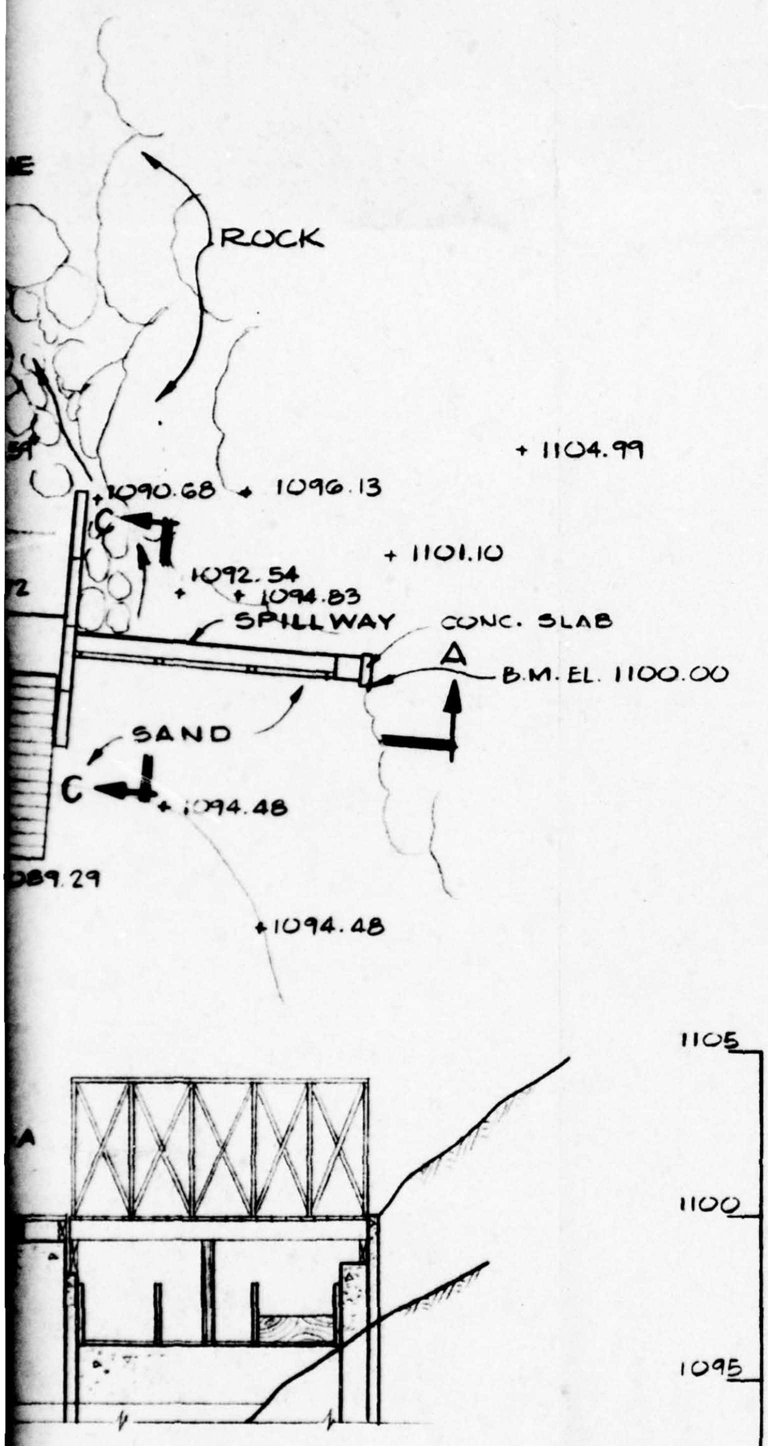
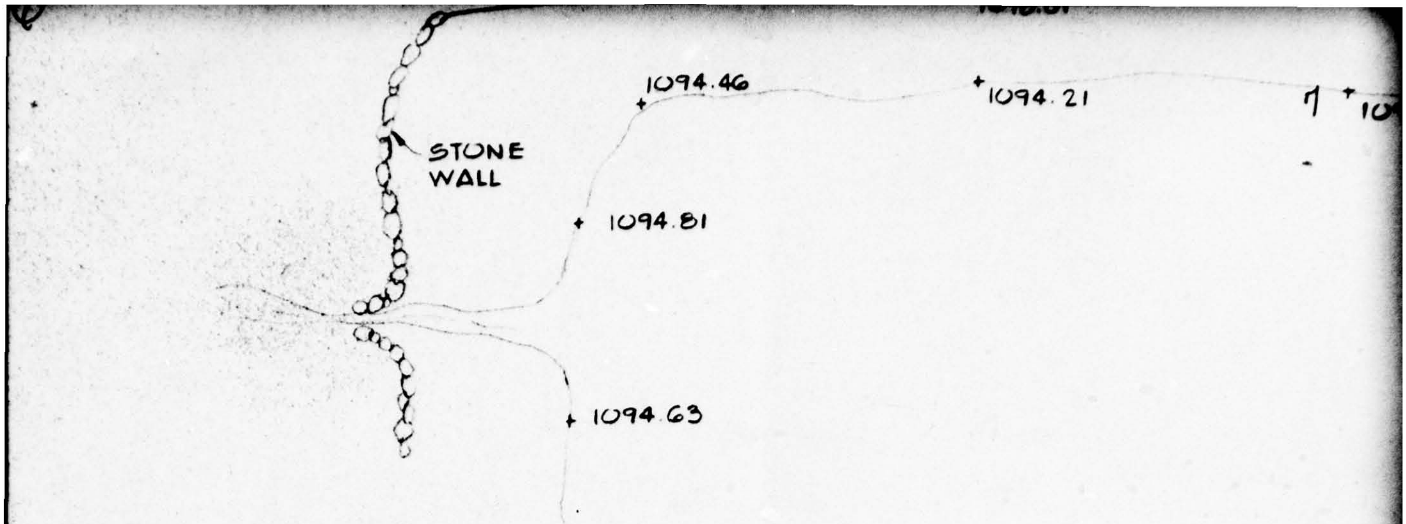
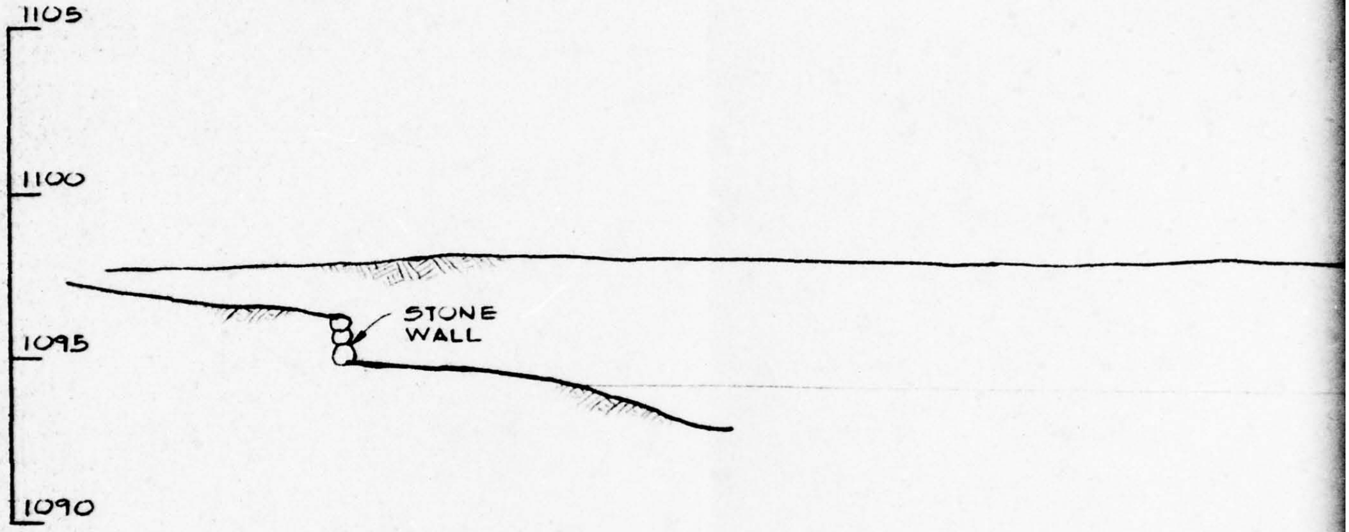
C
1098.40
1098.93
1098.72
1098.25
1097.11
1098.70
1096.71
A
1098.24
RIP - RAP
1094.08
1094.23
1094.14
SAND
C
WOOD PIER
1089.29
SPILLWAY FOR DETAILS SEE SECTION A-A



10

DATE	DESCRIPTION	NO.
REVISIONS		


STONE
WALL
1094.46
1094.21
1094.81
1094.63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STONE
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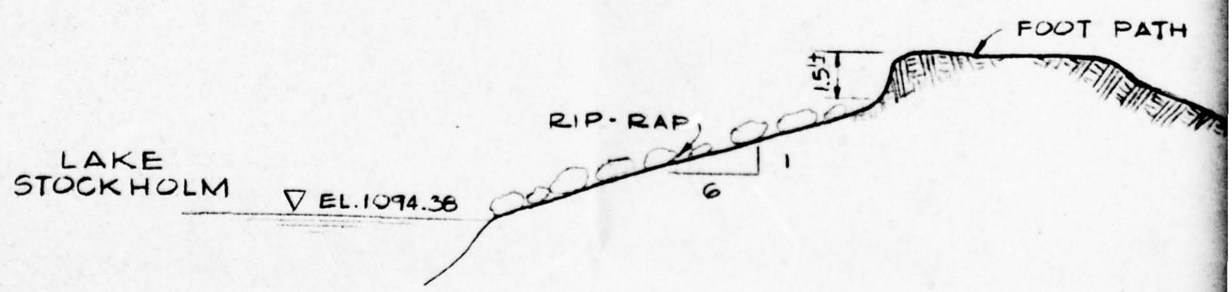
FOOT PATH
1.5±
RIP-RAP
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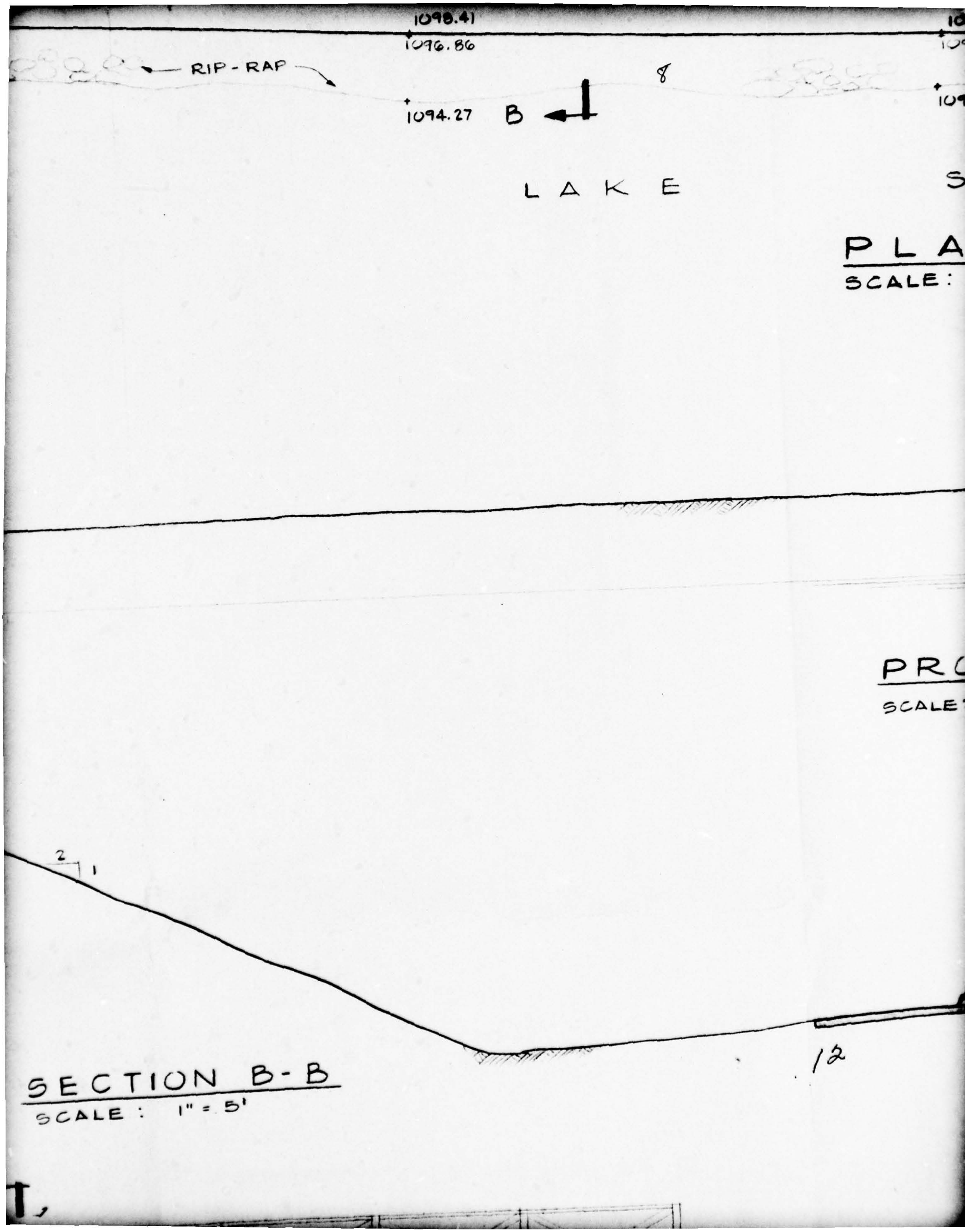
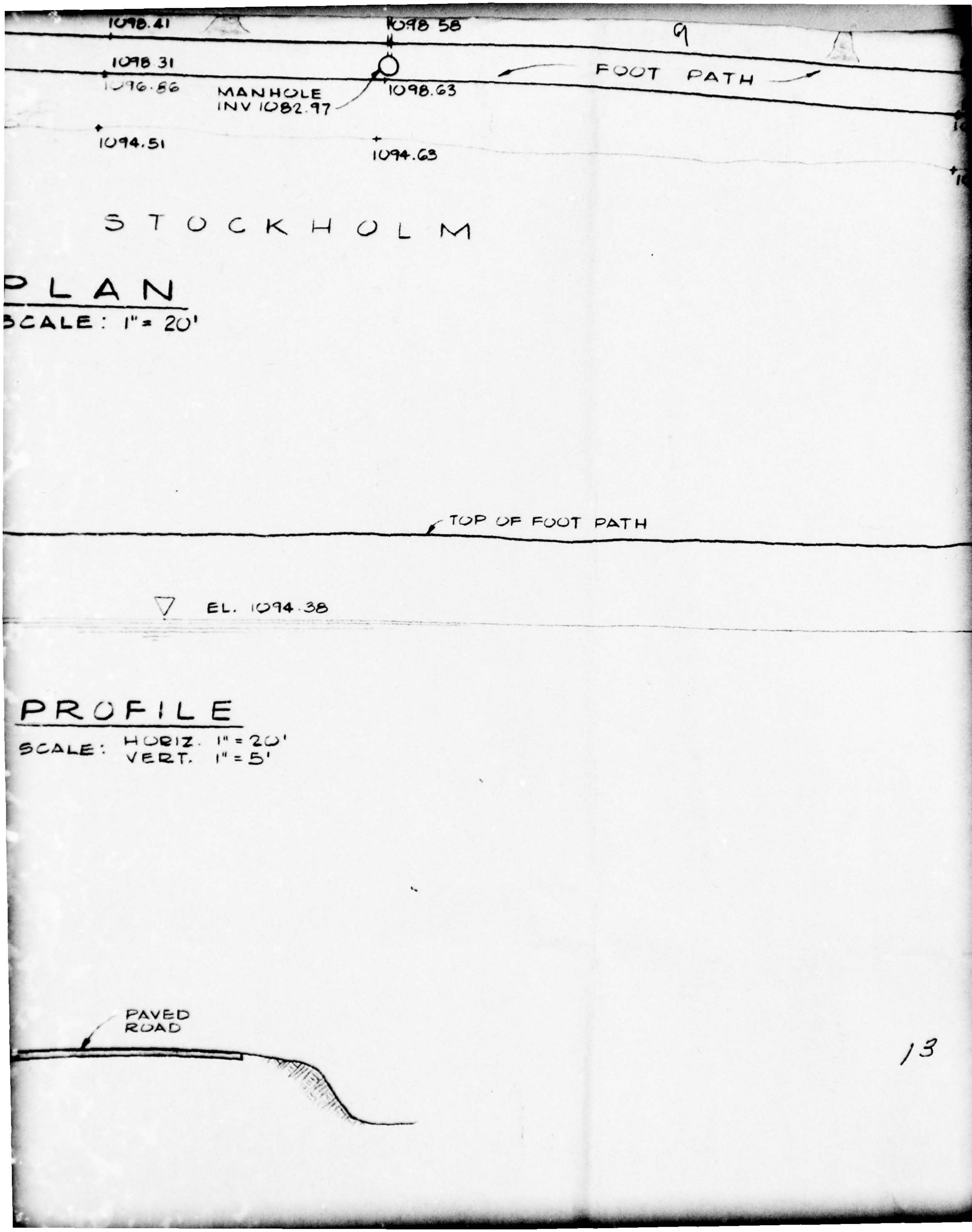
6
LAKE
STOCKHOLM
▽ EL.1094.38

11

C


1098.41
1096.86
RIP - RAP
8
1094.27
B
LAKE
S
PLA
SCALE:
PRO
SCALE:
2
1
12
SECTION B-B
SCALE: 1" = 5'


1098.41
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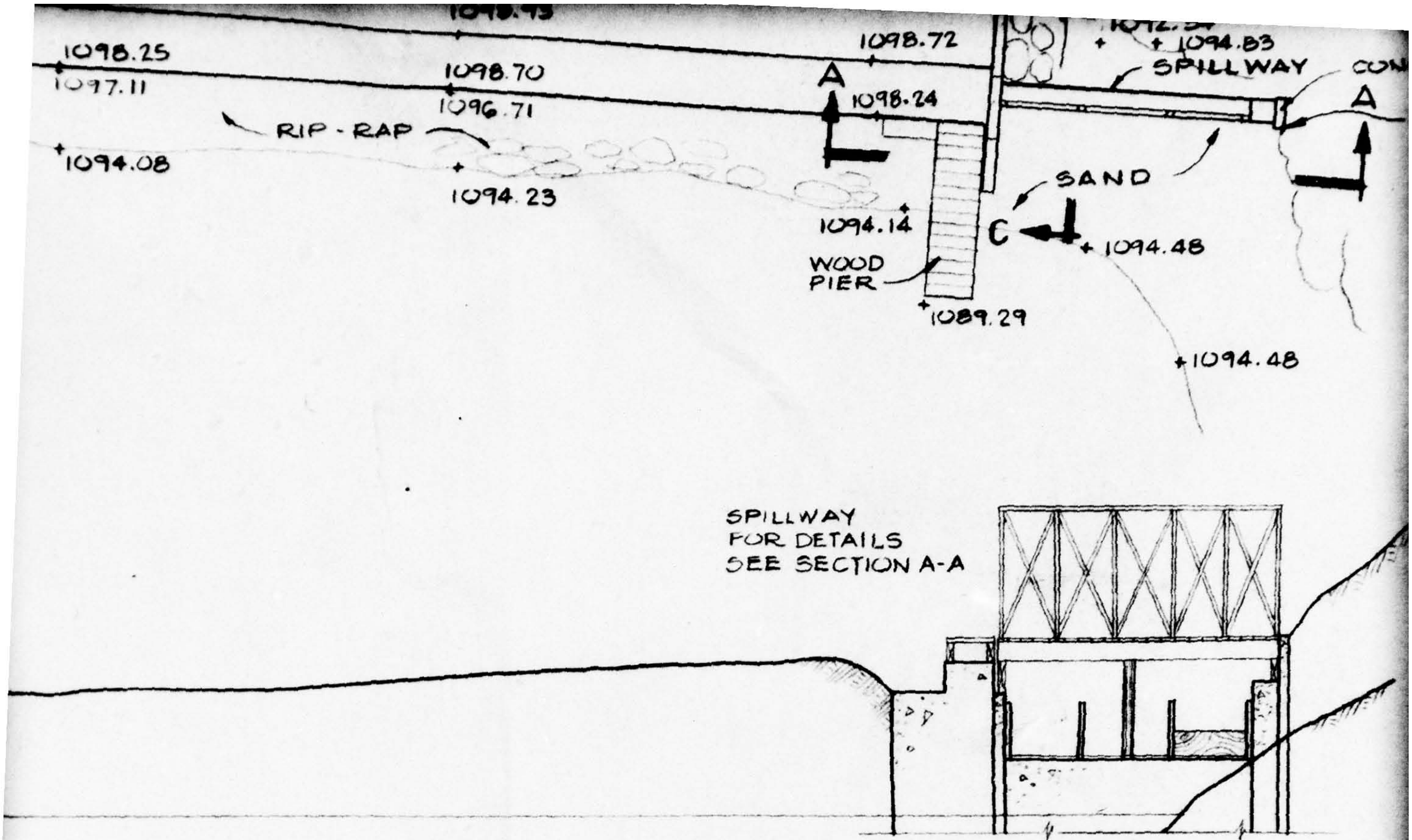
MANHOLE
INV 1082.97
1098.63
FOOT PATH
1094.51
1094.63
STOCKHOLM
PLAN
SCALE: 1" = 20'
TOP OF FOOT PATH
EL. 1094.38
PROFILE
SCALE: HORIZ. 1" = 20'
VERT. 1" = 5'
PAVED
ROAD
13

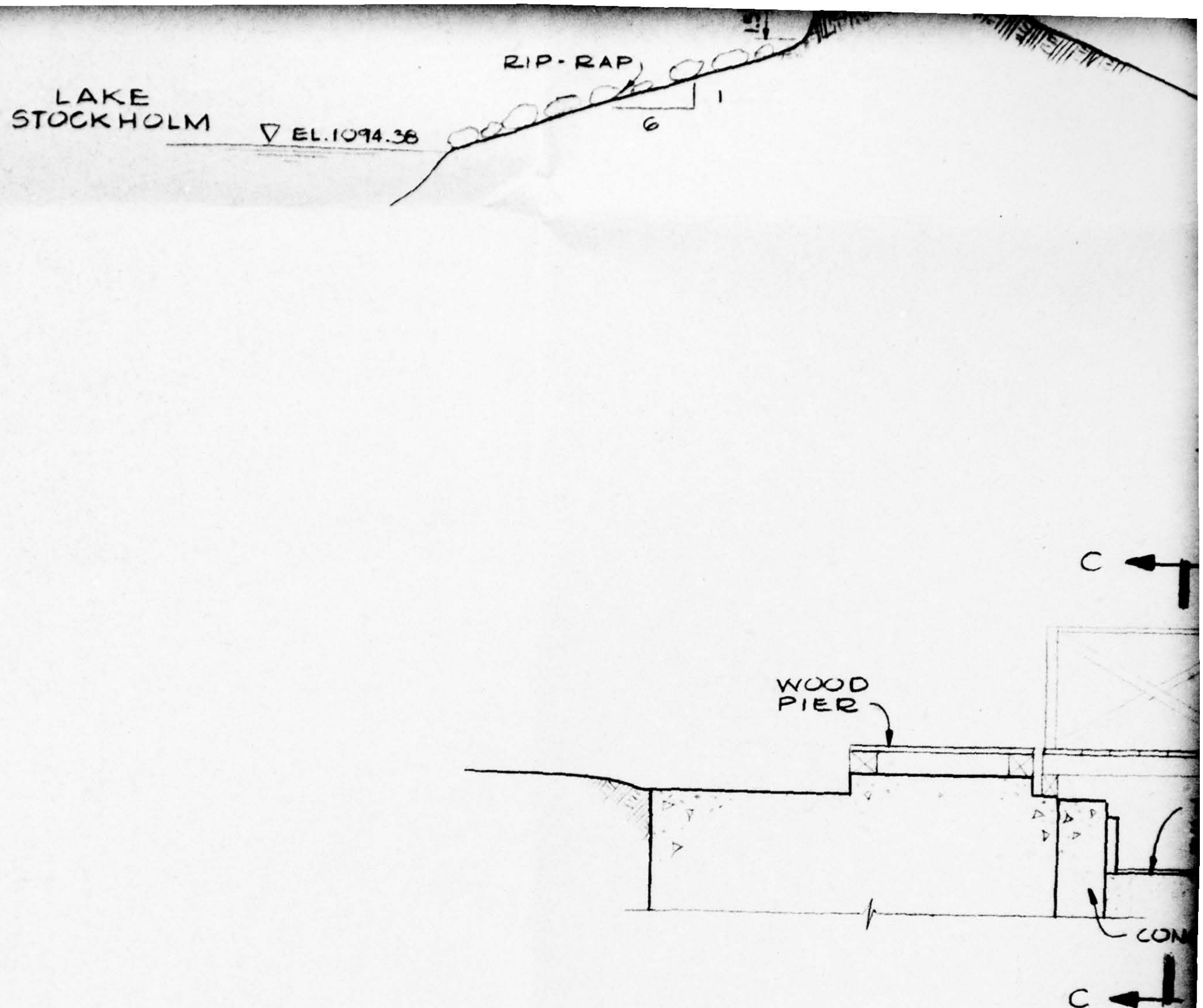

1098.25
1097.11
1094.08
RIP - RAP
1098.70
1096.71
1094.23
1098.72
A
1098.24
1094.14
WOOD
PIER
1089.29
SAND
C
1094.48
1094.48
1094.83
SPILLWAY
A
SPILLWAY
FOR DETAILS
SEE SECTION A-A

13

NOTE:

DATE	DESCRIPTION	NO.

REVISIONS

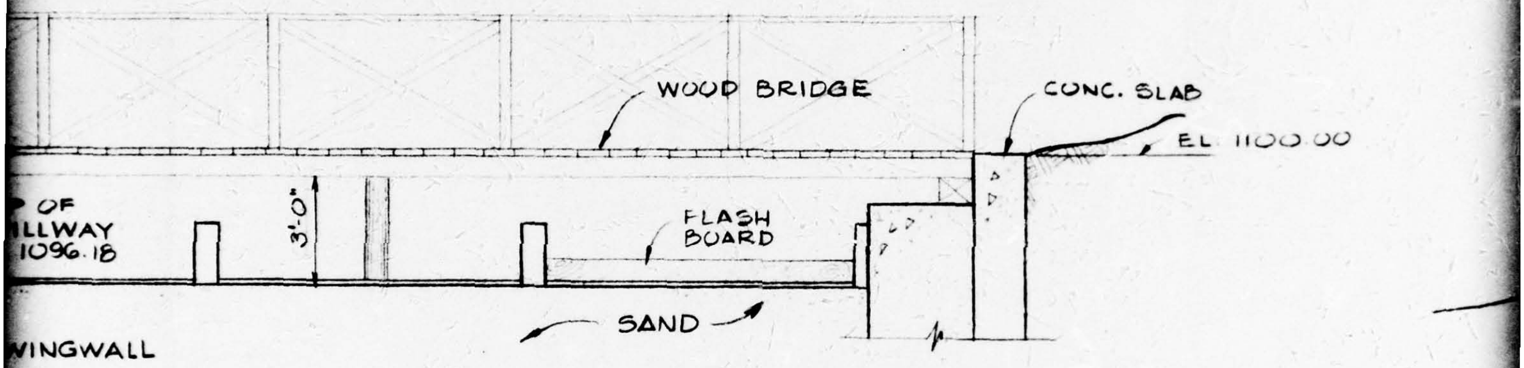


16

ECTION B-B

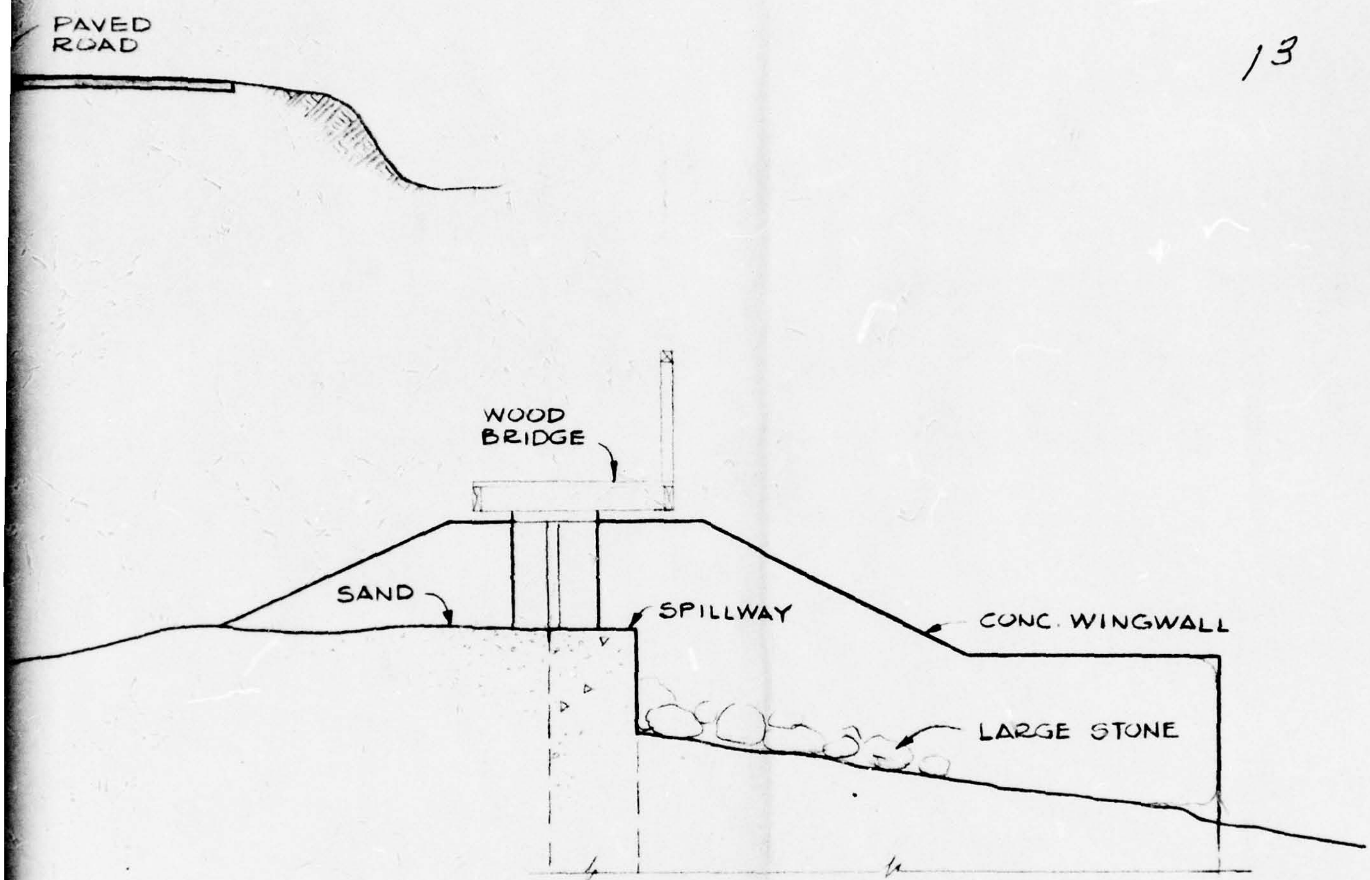
CALE : 1" = 5'

12



SECTION A-A

SCALE 1" = 5'



SECTION C-C
SCALE 1" = 5'

14

NOTE:

THE ELEVATIONS SHOWN WERE OBTAINED USING A SURVEYOR'S TRANSIT AND LEVEL AND THE USGS MAP FOR FRANKLIN, N.J. QUADRANGLE. THE REFERENCE ELEVATION OF 1100.00 AT THE S.E. CORNER OF THE CONC. SLAB WAS USED AS BENCH MARK. THESE ELEVATIONS ARE APPROXIMATE.

DATE	DESCRIPTION	NO.
	REVISIONS	

15

PROJECT

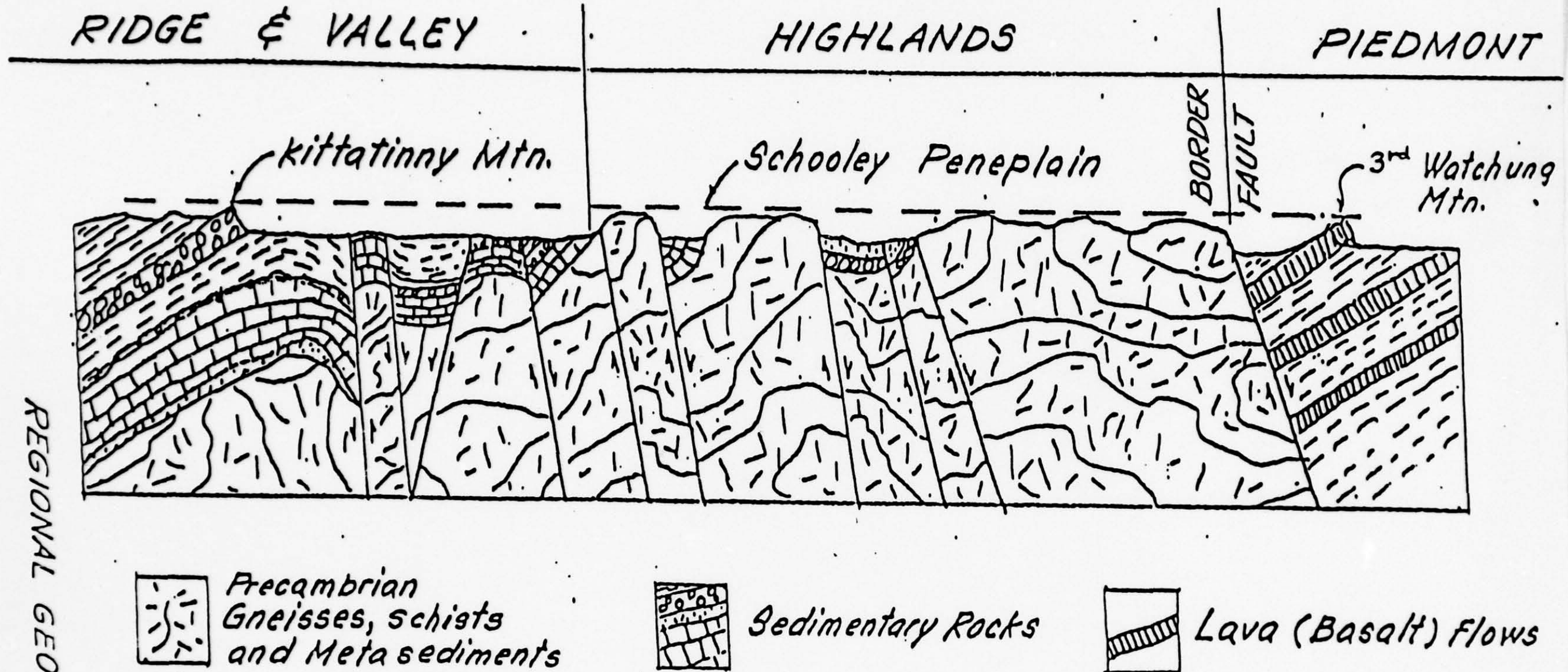
PHASE I
INSPECTION & EVALUATION of NEW JERSEY DAMS

DRAWING TITLE

LAKE STOCKHOLM
NOVEMBER 1978
FED. I.D. NO. N.J.00302

JOB NO. J - 783B	DRAWING NO. FIG. 2
DATE 13 NOV 1978	
SCALE AS NOTED	
DRN. BY J. R.	
CHKD. BY DJL	

20



Schematic Cross-section of New Jersey Highlands Physiographic Province (After Wolfe; 1977)

REGIONAL GEOLOGIC FEATURES

Fig. 3

APPENDIX I

CHECK LIST

VISUAL INSPECTION

LAKE STOCKHOLM DAM

CHECK LIST
VISUAL INSPECTION
Phase I

NAME DAM Lake Stockholm COUNTY Sussex STATE New Jersey COORDINATORS N.J. DEP

DATE(s) INSPECTION See Below WEATHER Cloudy TEMPERATURE 40° F

POOL ELEVATION AT TIME OF INSPECTION 1094* M.S.L. TAILWATER AT TIME OF INSPECTION 1082* M.S.L.

* BM of 1100 at S.E. corner (Ref. note Fig. 2)

INSPECTION PERSONNEL:

J. Richards	12/2/78 11/29/78	J. Rizzo	11/9/78	
D. Leary	12/2/78 11/29/78	P. Yu	11/9/78	
C. Campbell	11/9/78			

James Richards RECORDER

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Trees and brush in channel.	Remove trees and brush.
SLOPES	Appears Satisfactory	
APPROXIMATE NO. OF HOMES AND POPULATION	More than 20 homes at relatively high elevations shown on USGS Topo Map. Est. population greater than 100 people.	An alarm system should be installed.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None Observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion on both upstream and downstream slopes. Depth of erosion on upstream 1 1/2 - 2 ft.	Eroded areas should be repaired.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical sags at several areas 6 inches to 1 ft.	Low areas should be suitably backfilled.
RIPRAP FAILURES	Downstream riprap missing over considerable portion of embankment.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Left spillway abutment - erosion about one foot deep.	
ANY NOTICEABLE SEEPAGE	None Observed	
STAFF GAGE AND RECORDER	None Observed	
DRAINS	None Observed	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Left sidewall of spillway - Concrete cracked at several locations downstream concrete spalled and deteriorated.	Concrete should be repaired.
INTAKE STRUCTURE	Manhole located in center of dam. Gate not observed.	
OUTLET STRUCTURE	None observed	
OUTLET CHANNEL	None observed	
EMERGENCY GATE	None observed.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARK OR RECOMMENDATIONS
SLOPES	Appears satisfactory	
SEDIMENTATION	Estimate considerable accumulated settlement.	

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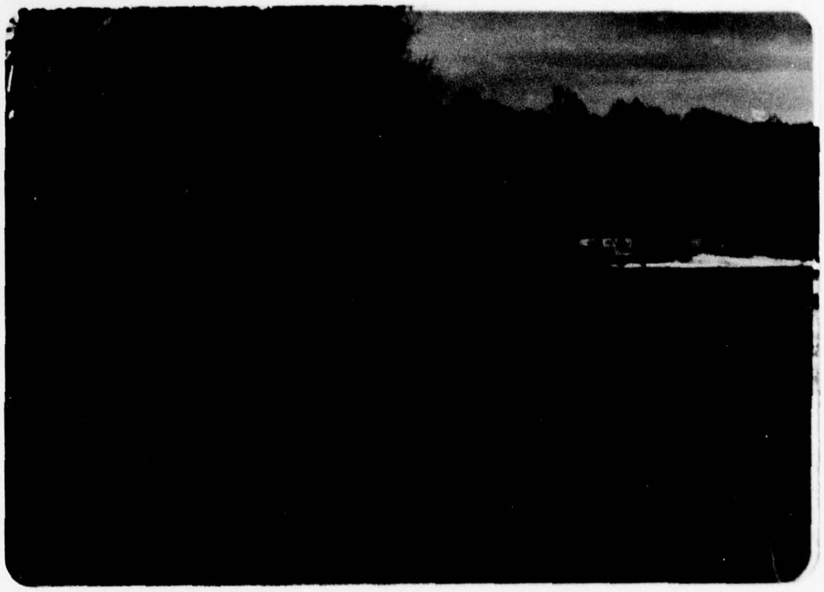
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Minor spalling on downstream side.	
APPROACH CHANNEL	Appears Satisfactory	
DISCHARGE CHANNEL	Large boulders in channel.	
BRIDGE AND PIERS	No railing on upstream portion of steel framed wooden bridge which extends over spillway.	Railing should be installed.

APPENDIX 2

PHOTOGRAPHS

LAKE STOCKHOLM DAM



Upstream face of dam. Note absence of riprap. 29 November 1978

Crest of dam. Looking East. 29 November 1978

LAKE STOCKHOLM DAM

17 18

Spillway. Looking downstream. 29 November 1978

Roadway behind dam. Looking east. 29 November 1978

LAKE STOCKHOLM DAM

Spillway. Looking upstream. Note vertical crack in spillway left side wall. 29 November 1978

Spillway discharge channel. Looking upstream. 29 November 1978

LAKE STOCKHOLM DAM

DRN. BY J. R.	
CHKD. BY DJL	

20

Left spillway - embankment abutment. 29 November 1978

Rock at spillway right abutment. 29 November 1978

LAKE STOCKHOLM DAM

REGIONAL GEOLOGIC FEATURES Fig. 3

Erosion at top of embankment. 29 November 1978

Erosion of crest and downstream side of embankment. 29 November 1978

LAKE STOCKHOLM DAM

Manhole at top of embankment. 29 November 1978

Wet marshy area downstream of embankment. 20 November 1978

Deteriorated upstream riprap. 29 November 1978

Open work rock below crest of dam. 29 November 1978

LAKE STOCKHOLM DAM

HYDROLOGICAL COMPUTATIONS
LAKE STOCKHOLM DAM

A **Location** Sussex County, N.J. – Passaic River Basin

B. **Drainage Area** 415 acres or 0.65 sq. mi

C. **Lake Area** 33 acres

D **Classification** size — small (less 1000 acre ft)
Hazard - significant

E. **Spillway Design Flood** – 1/2 PMF

F. **PMP**

1. Dam located in Zone 1 (near zone 6 boundary
PMP = 22.0 inches (200 sq mi - 24 hr)

2. PMF must be adjusted for basin size

Duration	% Factor (for 10 sq. mi) Zone 1	Zone 6	Average	Reduction Factor*
0-6	112	112	112	0.8 for all hours
0-12	123	123	123	
0-24	133	132	132	
0-48	142	142	142	

* page 48 "Small Dams"

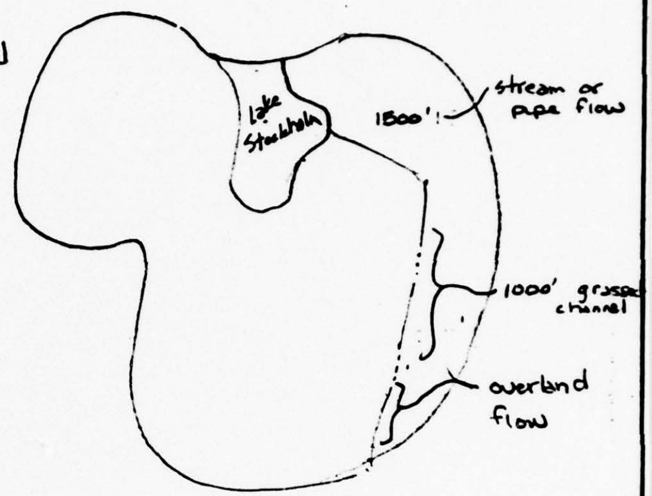
LANGAN ENGINEERING ASSOCIATES, INC.

DETERMINE TIME OF CONCENTRATION

1. Watershed is 75% woodland
25% residential
2. No major stream channels
3. Slopes

$\frac{155'}{2000} = .078$

$\frac{100}{1500}$ .067



4. Estimate of Tc based on velocity and lengths

	slope	velocity	remarks
Overland flow	$\frac{95'}{1000}$	.8 fps	wooded
Reach #1	$\frac{60}{1000}$	3.6 fp	grass waterway
Reach #2	$\frac{100}{1500}$	5.2	

$$T_c = \left[\frac{1000}{.8} + \frac{1000}{3.6} + \frac{1500}{5.2}\right] \div 3600 = .50 \text{ hrs}$$

5. State DEP Nomograph

$\Delta H = 255$

$L - 3500'$

$t_c = 11$ min

BY CED DATE 1-17-79 Lake Stockholm Dam JOB NO. J-783 B

CKD DWF DATE 1-17-79 SHEET NO. 2 OF 10

VISUAL E | JUNCTIO AND ABU AND DAM | ANY NOT | STAFF G | DRAINS | 1-4

LANGAN ENGINEERING ASSOCIATES, INC.

6. Curve Number Method SCS (Tech Release 55 Fig 3.3)

$l = 3500$

Avg slope = 7.3%

CN = 70

$L = .44$

$T_c = \frac{L}{.6} = \frac{.44}{.6} = .73$ hrs

use $T_c = .6$ hrs

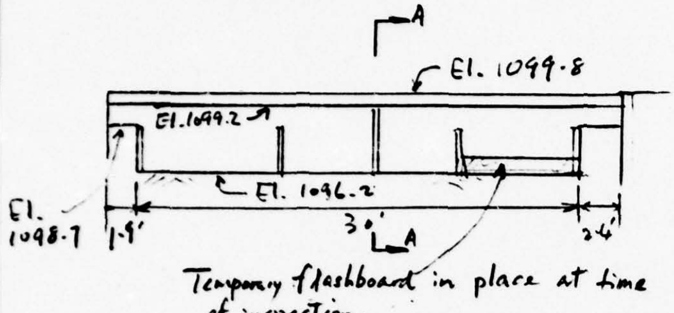
$\therefore \quad L = 0.6 \times 0.6 = \underline{\underline{.36 hr}}$

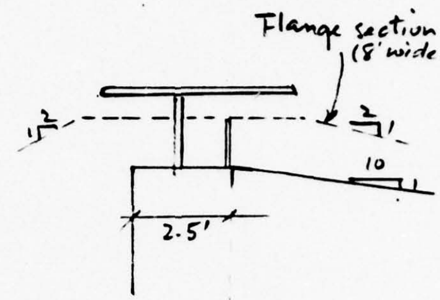
BY CED DATE 1.17.79 Lake Stockholm Dam JOB NO. J-783 B

CKD. [illegible] DATE 1-17-79 SHEET NO. 3 OF 10

LANGAN ENGINEERING ASSOCIATES, INC.

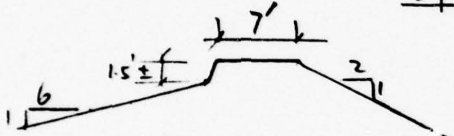
SPILLWAY CAPACITY





Section A-A

Spillway



Dam Section (Type)

Since the discharge end of the 12"ϕ pipe in the manhole could not be located, ∴ it is not considered in the analysis.

Existing condition indicates a 10' temporary flashboard is in place. The board is about 6 inches high. Since it is temporary in nature, and its effect on the total discharge of the spillway and the dam is relatively insignificant, therefore its existance is not included in developing the spillway rating curve.

For spillway section, take C value with reference to Table 5-11 of "Handbook of Hydraulics" by King & Brater. Since it has a wider crest and flatter upstream slope than the model, choose $C = 3.20$, with $L = 29$ ft.

Spillway flange section has trapezoidal section, similarly the crest is much wider than the model used, choose $C = 2.90$ with reference to Table 5-9 on pg. 5-49 of King & Brater, 5th Ed. $L = 4.3'$

For dam section, use $C = 2.90$,
$L = 570'$ at el. 1098.4'

Dam slopes up beyond 570' (Estimated to be 1 vert to 7 Hor.)

BY Pz	DATE 1-17-79 3-19-79 Lake Stockholm	JOB NO. J-783 B	
CKD ED	DATE 3.19.79	SHEET NO. 4	OF 10

LANGAN ENGINEERING ASSOCIATES, INC.

Elev. (ft)	Spillway				Dam			Total Q (cfs)
	Main Section		Flange Section					
	H(ft)	Q_s(cfs)	H(ft)	Q_f(cfs)	H(ft)	L(ft)	Q_d(cfs)	$Q_T=Q_s+Q_f+Q_d$
1096.2	0							0
1097.2	1	93						93
1098.4	2.2	303			0			303
1098.7	2.5	367	0		0.3	571	272	639
1099.2	3	482	0.5	4	0.8	573	1189	1675
1100.2	4	742	1.5	28	1.8	576	4034	4804
1101.2	5	1037	2.5	49	2.8	580	7881	8967
1102.2	6	1364	3.5	82	3.8	583	12524	13970
1103.2	7	1719	4.5	119	4.8	587	17902	19740

$$Q = C L H^{3/2}$$

For Spillway :

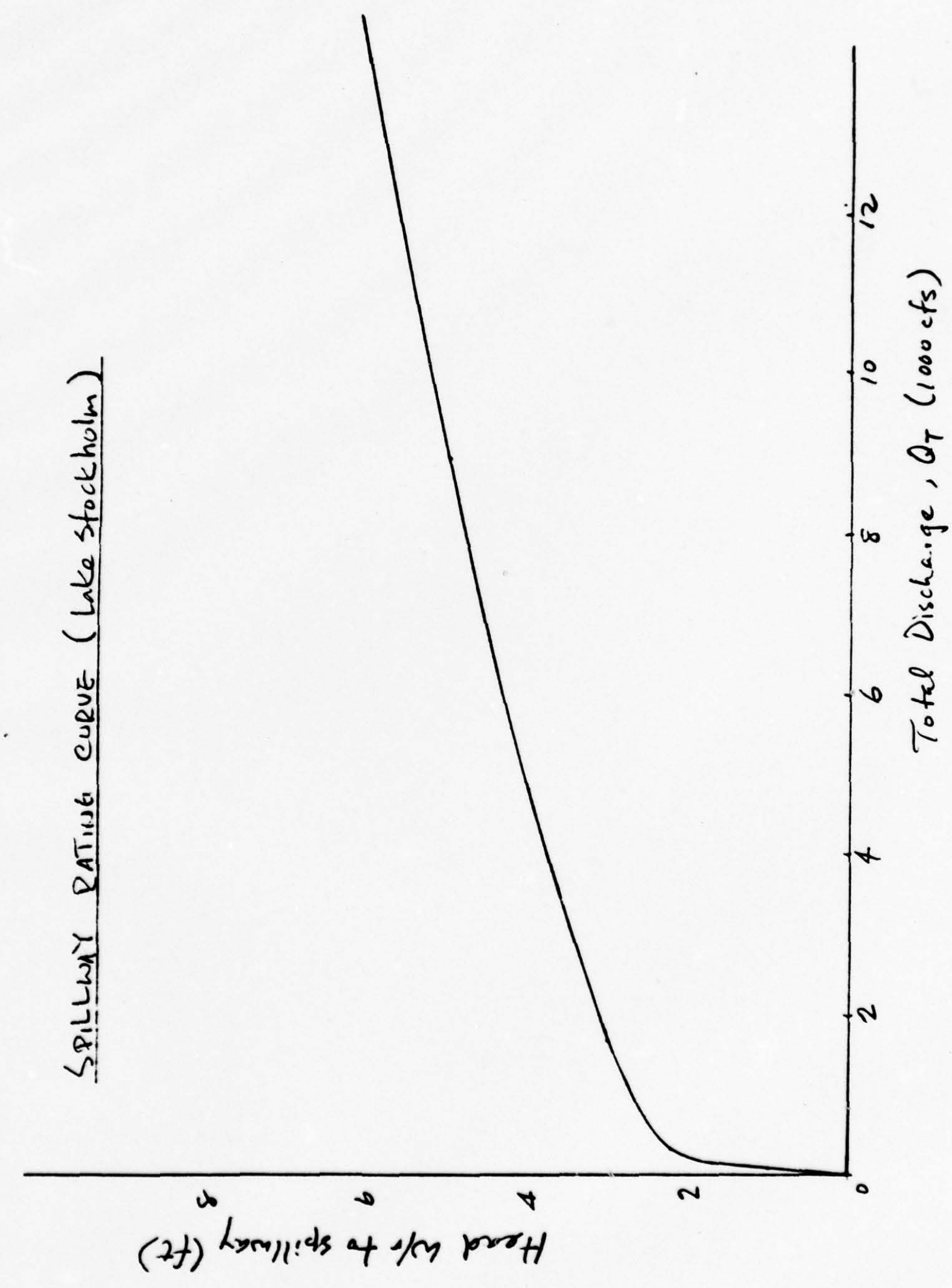
Main Section — $C = 3.20$
$L = 29$ ft

Flange Section — $C = 2.90$
$L = 4.3$ ft

For Dam : $C = 2.90$

BY. Dy DATE 1-17-79 Lab Stockholm JOB NO. J-783 B
CKD GED DATE 5.19.79 SHEET NO. 5 OF 10

LANGAN ENGINEERING ASSOCIATES, INC.



BY Dry	DATE 1-18-79 Lake Stockholm	JOB NO. I-763B	
CKD GED	DATE 3-19-79	SHEET NO. 6	OF 10

Reservoir Storage Capacity

Assume a linear distribution for the area of the lake with elevation. Start at a zero storage at the crest of the spillway.

Area of lake = 33 Acres.

Perimeter of lake ≐ 5400 ft (measured from U.S.G.S. map)

Since the perimeter is estimated from U.S.G.S. map, ∴ for estimated analysis, it is assumed to be constant within the working elevation range.

∴ for every foot of water above the crest of spillway, the area of the lake increases by

$$\frac{6\,(5400)}{43560} = 0.74 \text{ acres}$$

Elev. (ft)	H (ft)	Increase in Lake Area (Acres)	Area of Lake (Acres)
1096.2	0		33
1097.2	1	0.74	33.74
1098.2	2	1.48	34.48
1099.2	3	2.22	35.22
1100.2	4	2.96	35.96
1101.2	5	3.7	36.7
1102.2	6	4.44	37.44
1103.2	7	5.18	38.18

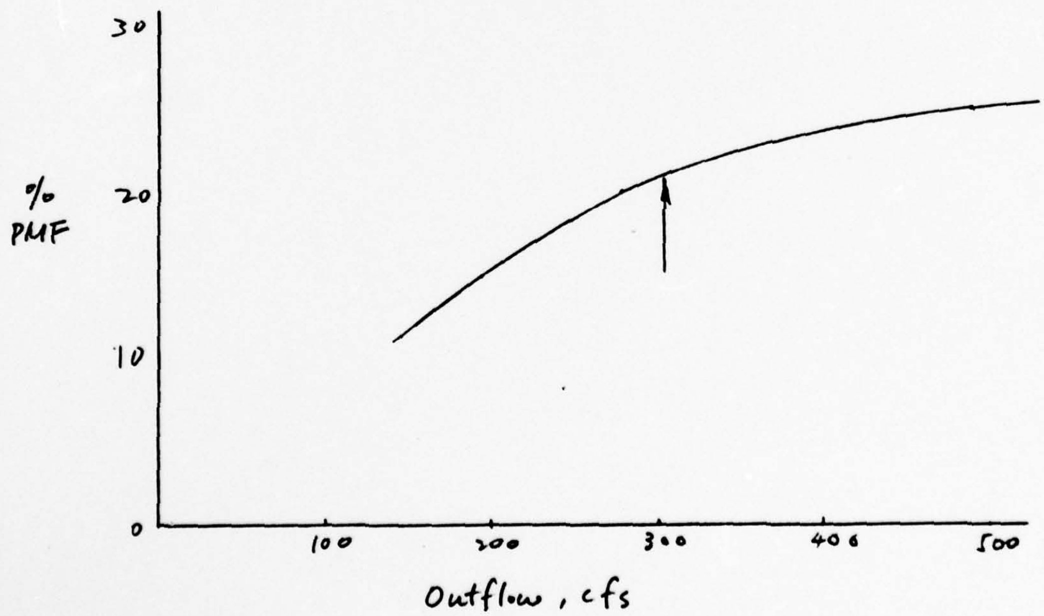
LANGAN ENGINEERING ASSOCIATES, INC.

SUMMARY OF HYDROGRAPH AND FLOOD ROUTING

1. Hydrograph and routing calculated using HEC-1
2. ½ PMF for Lake Stockholm is 1971 cfs (routed to 1725 cfs)
3. Routing indicates the dam will overtop by approximately 0.8 ft for ½ PMF

OVERTOPPING POTENTIAL

1. Various % of PMF have been routed using HEC-1
2. Plot peak outflow vs % PMF



3. Dam overtops at approx. 1098.4 with Q = 303 cfs
∴ dam can pass approx. 21% of the PMF.

BY Py DATE 1-18-79 Lake Stockholm Dam JOB NO. J-783 B

CKD CED DATE 3.19.79 SHEET NO. 8 OF 10

DRAWDOWN ANALYSIS

1. Outlet Structure

One 12-in dia C.I. low level outlet pipe with gate valve. (outlet appeared not functioning during inspection)

Note: For this analysis, the outlet for the pipe is assumed to be functioning properly.

2. Outlet Capacity

a. Elevation of centerline of outfall end of pipe = 1082.6 (Est.)

b. El. of Lake = 1096.2 (Top of spillway). Take length of pipe = 100'

c. Pipe capacity based on

$$Q = C_p H^{1/2} \text{ where } C_p = A_p \sqrt{\frac{2g}{1+K_m+K_p L}},$$

using $n = 0.025$, $K_p = 0.1157$ (NEH Section 5, ES-42)

$A_p = 0.785$, $K_m = 0.9$

$C_p = 1.716$, $Q = 1.716 H^{1/2}$

Elev. (ft)	Head (ft)	Q (cfs)	Q_{avg} (cfs)
1096.2	13.6	6.33	
			6.1
1094.6	12	5.94	
			5.7
1092.6	10	5.43	
			5.1
1090.6	8	4.85	
			4.5
1088.6	6	4.20	
			3.8
1086.6	4	3.43	
			2.9
1084.6	2	2.43	
			1.2
1082.6	0	0	

LANGAN ENGINEERING ASSOCIATES, INC.

3. Storage Capacity

a. Estimate storage below spillway is 300 ac. ft

b. Assume area varies linearly with height, assume bottom of lake at 1082.6 with area ≐ 11 acres

Elev.	Area (Ac)	ΔStorage (ac-ft)	Total Storage
1096.2	33		300
		51	
1094.6	30		
		57	
1092.6	27		
		51	
1090.6	24		
		45	
1088.6	21		
		38	
1086.6	17		
		31	
1084.6	14		
		25	
1082.6	1.1		

4. Assume inflow to be 2 cfs/sq. mi

$Q_{in} = 0.65 \times 2 = 1.3$ cfs

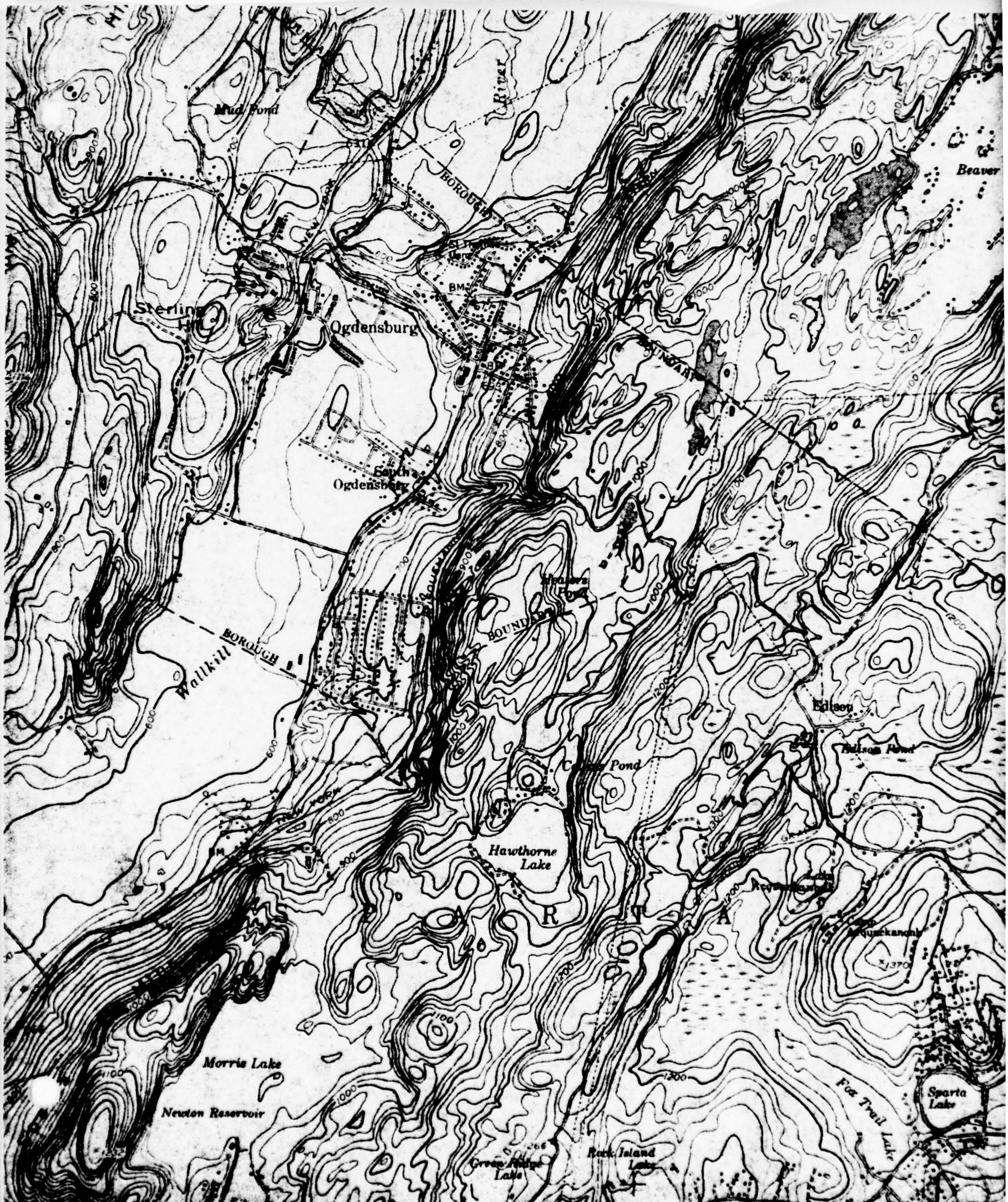
Elev. (ft)	Q_{out} avg. (cfs)	Q_{net}* (cfs)	ΔStorage (Ac-ft)	Δt (hr.)	ΣΔt (hrs)
1096.2					
	6.1	4.8	51	129	
1094.6					
	5.7	4.4	57	157	286
1092.6					
	5.1	3.8	51	162	
1090.6					
	4.5	3.2	45	170	
1088.6					
	3.8	2.6	38	177	
1086.6					
	2.9	1.6	31	234	1029
1084.6					
					or 43 days

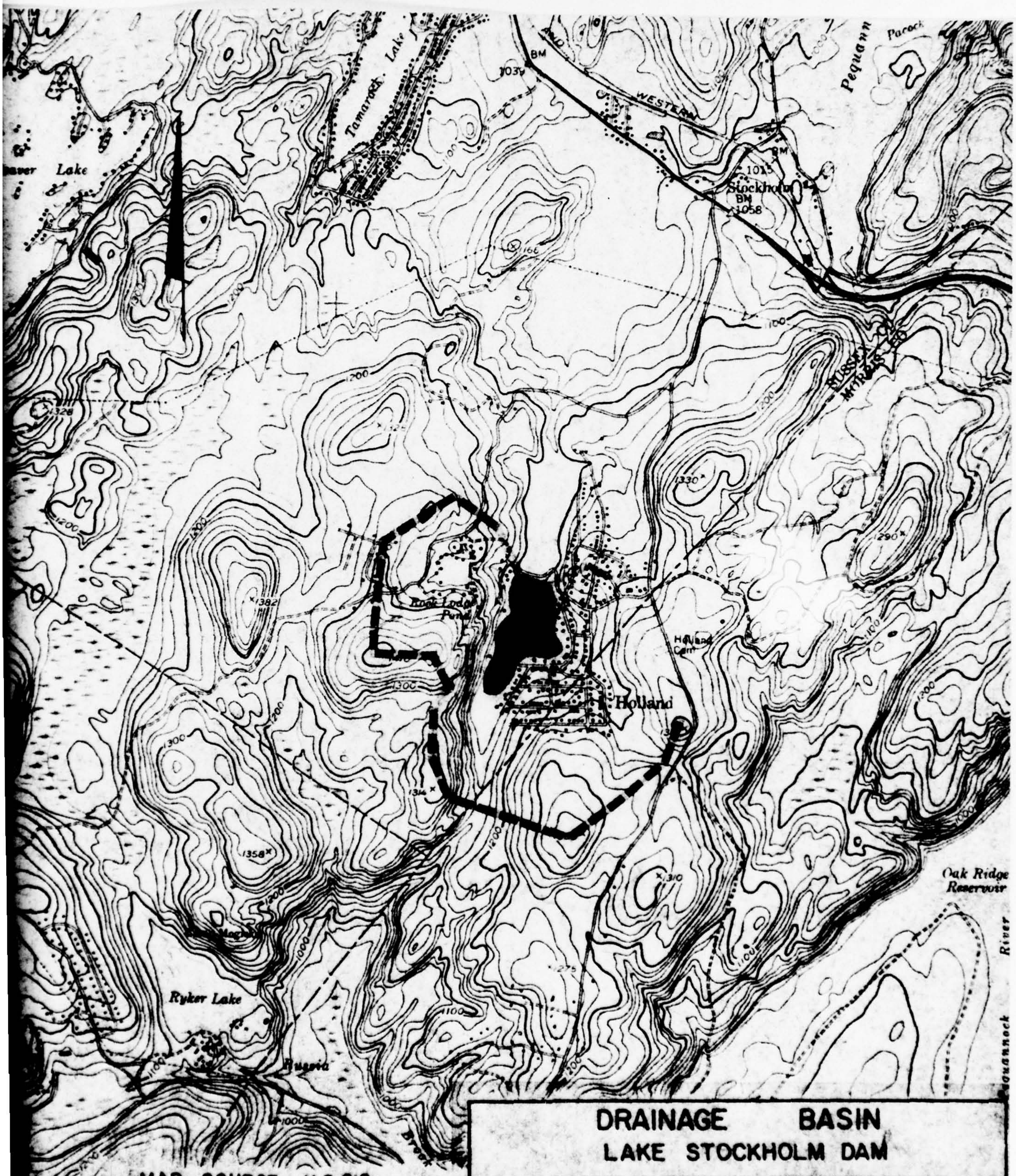
* $Q_{net} = Q_{out\,avg} - Q_{in} = Q_{out\,avg} - 1.3$

∴ Lake lowed 4 feet in about 12 days and 12 feet in about 43 days

BY Rg DATE 1-22-79 Lake Stockholm Dam JOB NO. J-783 B

CKD GFD DATE 3-19-79 3-19-79 SHEET NO. 10 OF 10


Mud Pond
River
Beaver
BOROUGH
Sterling Hill
Ogdensburg
BOUNDARY
South Ogdensburg
BOROUGH
BOUNDARY
Wallkill
Edison
Edison Pond
Hawthorne Lake
Morris Lake
Newton Reservoir
Sparta Lake
Fox Trail Lake
Green Ridge Lake
Rock Island Lake



DRAINAGE BASIN
LAKE STOCKHOLM DAM

LANGAN ENGINEERING ASSOCIATES, INC.

CONSULTING ENGINEERS

990 CLIFTON AVE CLIFTON, N.J. 07013 201 472-9366

MAP SOURCE: U.S.G.S.
FRANKLIN
SCALE 1" = 2000'

HEC-1 OUTPUT

LAKE STOCKHOLM DAM

```
STOUT1      16:12 JAN 25,'79

1*********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  25 SEP 78
 *********************************
     1               A              LAKE STOCKHOLM DAM
     2               A              INFLOW HYDROGRAPHY AND ROUTING
     3               A              N.J. DAM INSPECTION
     4               B     290       0      10       0       0       0       0       0       0       0
     5               B1      5
     6               J       1       1       1
     7               J1     .5
     8               K               1                                       1
     9               K1  COMPUTE HYDROGRAPH
    10               M       1       2    0.65                     0.8
    11               P            22.0     112     123     132     142
    12               T                                                       1     .15
    13               W2           0.36
    14               X      -2               1
    15               K       1       2                                       1
    16               K1  ROUTING COMPUTATIONS
    17               Y                               1
    18               Y1      1                                                      -1
    19               Y41096.2  1097.2  1098.4  1098.7  1099.2  1100.2  1101.2  1102.2  1103.2
    20               Y5      0      93     303     639    1675    4804    8967   13970   19740
    21               $A   33.0    33.7    34.5    35.2    36.0    36.7    37.4    38.2
    22               $E1096.2  1097.2  1098.2  1099.2  1100.2  1101.2  1102.2  1103.2
    23               $$1096.2
    24               $D1098.4
    25               K      99
1                                PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                     RUNOFF HYDROGRAPH AT          1
                                     ROUTE HYDROGRAPH TO           2
                                     END OF NETWORK


1*********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  25 SEP 78
 *********************************

 RUN  DATE# 79/01/25.
      TIME# 10.45.06.
```

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                    LAKE STOCKHOLM DAM
                    INFLOW HYDROGRAPHY AND ROUTING
                    N.J. DAM INSPECTION

                                 JOB SPECIFICATION
    NQ      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
   290        0       10        0        0        0        0        0        0        0
                            JOPER      NWT    LROPT    TRACE
                                5        0        0        0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                               NPLAN= 1 NRTIO= 1 LRTIO= 1
     RTIOS=      .50


**********         **********         **********         **********         **********

                            SUB-AREA RUNOFF COMPUTATION

   COMPUTE HYDROGRAPH

                  ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                      1        0        0        0        0        0        1        0        0

                                 HYDROGRAPH DATA
   IHYDG    IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
       1       2      .65     0.00      .65      .80    0.000        0        0        0

                                   PRECIP DATA
           SPFE      PMS       R6      R12      R24      R48      R72      R96
           0.00    22.00   112.00   123.00   132.00   142.00     0.00     0.00

                                    LOSS DATA
 LROPT   STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
     0    0.00     0.00     1.00     0.00     0.00     1.00     1.00      .15     0.00     0.00

                              UNIT HYDROGRAPH DATA
                           TC=  0.00     LAG=    .36

                                  RECESSION DATA
                 STRTQ=    -2.00     QRCSN=     0.00     RTIOR= 1.00

    UNIT HYDROGRAPH 13 END OF PERIOD ORDINATES, TC=      0.00 HOURS, LAG=     .36  VOL= 1.00
 199.       620.       688.       478.       242.       135.        72.        38.        21.        11.
   7.         3.         1.
```

U

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.10	1	.00	0.00	.00	1.	1.02	.20	146	.02	0.00	.02	1.
1.01	.20	2	.00	0.00	.00	1.	1.02	.30	147	.02	0.00	.02	1.
1.01	.30	3	.00	0.00	.00	1.	1.02	.40	148	.02	0.00	.02	1.
1.01	.40	4	.00	0.00	.00	1.	1.02	.50	149	.02	0.00	.02	1.
1.01	.50	5	.00	0.00	.00	1.	1.02	1.00	150	.02	0.00	.02	1.
1.01	1.00	6	.00	0.00	.00	1.	1.02	1.10	151	.02	0.00	.02	1.
1.01	1.10	7	.00	0.00	.00	1.	1.02	1.20	152	.02	0.00	.02	1.
1.01	1.20	8	.00	0.00	.00	1.	1.02	1.30	153	.02	0.00	.02	1.
1.01	1.30	9	.00	0.00	.00	1.	1.02	1.40	154	.02	0.00	.02	1.
1.01	1.40	10	.00	0.00	.00	1.	1.02	1.50	155	.02	0.00	.02	1.
1.01	1.50	11	.00	0.00	.00	1.	1.02	2.00	156	.02	0.00	.02	1.
1.01	2.00	12	.00	0.00	.00	1.	1.02	2.10	157	.02	0.00	.02	1.
1.01	2.10	13	.00	0.00	.00	1.	1.02	2.20	158	.02	0.00	.02	1.
1.01	2.20	14	.00	0.00	.00	1.	1.02	2.30	159	.02	0.00	.02	1.
1.01	2.30	15	.00	0.00	.00	1.	1.02	2.40	160	.02	0.00	.02	1.
1.01	2.40	16	.00	0.00	.00	1.	1.02	2.50	161	.02	0.00	.02	1.
1.01	2.50	17	.00	0.00	.00	1.	1.02	3.00	162	.02	0.00	.02	1.
1.01	3.00	18	.00	0.00	.00	1.	1.02	3.10	163	.02	0.00	.02	1.
1.01	3.10	19	.00	0.00	.00	1.	1.02	3.20	164	.02	0.00	.02	1.
1.01	3.20	20	.00	0.00	.00	1.	1.02	3.30	165	.02	0.00	.02	1.
1.01	3.30	21	.00	0.00	.00	1.	1.02	3.40	166	.02	0.00	.02	1.
1.01	3.40	22	.00	0.00	.00	1.	1.02	3.50	167	.02	0.00	.02	1.
1.01	3.50	23	.00	0.00	.00	1.	1.02	4.00	168	.02	0.00	.02	1.
1.01	4.00	24	.00	0.00	.00	1.	1.02	4.10	169	.02	0.00	.02	1.
1.01	4.10	25	.00	0.00	.00	1.	1.02	4.20	170	.02	0.00	.02	1.
1.01	4.20	26	.00	0.00	.00	1.	1.02	4.30	171	.02	0.00	.02	1.
1.01	4.30	27	.00	0.00	.00	1.	1.02	4.40	172	.02	0.00	.02	1.
1.01	4.40	28	.00	0.00	.00	1.	1.02	4.50	173	.02	0.00	.02	1.
1.01	4.50	29	.00	0.00	.00	1.	1.02	5.00	174	.02	0.00	.02	1.
1.01	5.00	30	.00	0.00	.00	1.	1.02	5.10	175	.02	0.00	.02	1.
1.01	5.10	31	.00	0.00	.00	1.	1.02	5.20	176	.02	0.00	.02	1.
1.01	5.20	32	.00	0.00	.00	1.	1.02	5.30	177	.02	0.00	.02	1.
1.01	5.30	33	.00	0.00	.00	1.	1.02	5.40	178	.02	0.00	.02	1.
1.01	5.40	34	.00	0.00	.00	1.	1.02	5.50	179	.02	0.00	.02	1.
1.01	5.50	35	.00	0.00	.00	1.	1.02	6.00	180	.02	0.00	.02	1.
1.01	6.00	36	.00	0.00	.00	1.	1.02	6.10	181	.05	.03	.03	7.
1.01	6.10	37	.00	0.00	.00	1.	1.02	6.20	182	.05	.03	.03	25.
1.01	6.20	38	.00	0.00	.00	1.	1.02	6.30	183	.05	.03	.03	45.
1.01	6.30	39	.00	0.00	.00	1.	1.02	6.40	184	.05	.03	.03	58.
1.01	6.40	40	.00	0.00	.00	1.	1.02	6.50	185	.05	.03	.03	65.
1.01	6.50	41	.00	0.00	.00	1.	1.02	7.00	186	.05	.03	.03	69.
1.01	7.00	42	.00	0.00	.00	1.	1.02	7.10	187	.05	.03	.03	71.
1.01	7.10	43	.00	0.00	.00	1.	1.02	7.20	188	.05	.03	.03	72.
1.01	7.20	44	.00	0.00	.00	1.	1.02	7.30	189	.05	.03	.03	73.
1.01	7.30	45	.00	0.00	.00	1.	1.02	7.40	190	.05	.03	.03	73.
1.01	7.40	46	.00	0.00	.00	1.	1.02	7.50	191	.05	.03	.03	74.
1.01	7.50	47	.00	0.00	.00	1.	1.02	8.00	192	.05	.03	.03	74.
1.01	8.00	48	.00	0.00	.00	1.	1.02	8.10	193	.05	.03	.03	74.

1.01	8.10	49	.00	0.00	.00	1.	1.02	8.20	194	.05	.03	.03	74.
1.01	8.20	50	.00	0.00	.00	1.	1.02	8.30	195	.05	.03	.03	74.
1.01	8.30	51	.00	0.00	.00	1.	1.02	8.40	196	.05	.03	.03	74.
1.01	8.40	52	.00	0.00	.00	1.	1.02	8.50	197	.05	.03	.03	74.
1.01	8.50	53	.00	0.00	.00	1.	1.02	9.00	198	.05	.03	.03	74.
1.01	9.00	54	.00	0.00	.00	1.	1.02	9.10	199	.05	.03	.03	74.
1.01	9.10	55	.00	0.00	.00	1.	1.02	9.20	200	.05	.03	.03	74.
1.01	9.20	56	.00	0.00	.00	1.	1.02	9.30	201	.05	.03	.03	74.
1.01	9.30	57	.00	0.00	.00	1.	1.02	9.40	202	.05	.03	.03	74.
1.01	9.40	58	.00	0.00	.00	1.	1.02	9.50	203	.05	.03	.03	74.
1.01	9.50	59	.00	0.00	.00	1.	1.02	10.00	204	.05	.03	.03	74.
1.01	10.00	60	.00	0.00	.00	1.	1.02	10.10	205	.05	.03	.03	74.
1.01	10.10	61	.00	0.00	.00	1.	1.02	10.20	206	.05	.03	.03	74.
1.01	10.20	62	.00	0.00	.00	1.	1.02	10.30	207	.05	.03	.03	74.
1.01	10.30	63	.00	0.00	.00	1.	1.02	10.40	208	.05	.03	.03	74.
1.01	10.40	64	.00	0.00	.00	1.	1.02	10.50	209	.05	.03	.03	74.
1.01	10.50	65	.00	0.00	.00	1.	1.02	11.00	210	.05	.03	.03	74.
1.01	11.00	66	.00	0.00	.00	1.	1.02	11.10	211	.05	.03	.03	74.
1.01	11.10	67	.00	0.00	.00	1.	1.02	11.20	212	.05	.03	.03	74.
1.01	11.20	68	.00	0.00	.00	1.	1.02	11.30	213	.05	.03	.03	74.
1.01	11.30	69	.00	0.00	.00	1.	1.02	11.40	214	.05	.03	.03	74.
1.01	11.40	70	.00	0.00	.00	1.	1.02	11.50	215	.05	.03	.03	74.
1.01	11.50	71	.00	0.00	.00	1.	1.02	12.00	216	.05	.03	.03	74.
1.01	12.00	72	.00	0.00	.00	1.	1.02	12.10	217	.33	.30	.03	128.
1.01	12.10	73	.02	0.00	.02	1.	1.02	12.20	218	.33	.30	.03	299.
1.01	12.20	74	.02	0.00	.02	1.	1.02	12.30	219	.33	.30	.03	488.
1.01	12.30	75	.02	0.00	.02	1.	1.02	12.40	220	.33	.30	.03	619.
1.01	12.40	76	.02	0.00	.02	1.	1.02	12.50	221	.33	.30	.03	685.
1.01	12.50	77	.02	0.00	.02	1.	1.02	13.00	222	.33	.30	.03	722.
1.01	13.00	78	.02	0.00	.02	1.	1.02	13.10	223	.39	.37	.03	755.
1.01	13.10	79	.03	0.00	.03	1.	1.02	13.20	224	.39	.37	.03	807.
1.01	13.20	80	.03	0.00	.03	1.	1.02	13.30	225	.39	.37	.03	858.
1.01	13.30	81	.03	0.00	.03	1.	1.02	13.40	226	.39	.37	.03	892.
1.01	13.40	82	.03	0.00	.03	1.	1.02	13.50	227	.39	.37	.03	910.
1.01	13.50	83	.03	0.00	.03	1.	1.02	14.00	228	.39	.37	.03	920.
1.01	14.00	84	.03	0.00	.03	1.	1.02	14.10	229	.49	.47	.03	944.
1.01	14.10	85	.04	0.00	.04	1.	1.02	14.20	230	.49	.47	.03	1008.
1.01	14.20	86	.04	0.00	.04	1.	1.02	14.30	231	.49	.47	.03	1077.
1.01	14.30	87	.04	0.00	.04	1.	1.02	14.40	232	.49	.47	.03	1125.
1.01	14.40	88	.04	0.00	.04	1.	1.02	14.50	233	.49	.47	.03	1149.
1.01	14.50	89	.04	0.00	.04	1.	1.02	15.00	234	.49	.47	.03	1163.
1.01	15.00	90	.04	0.00	.04	1.	1.02	15.10	235	.45	.42	.03	1161.
1.01	15.10	91	.03	0.00	.03	1.	1.02	15.20	236	.75	.72	.03	1198.
1.01	15.20	92	.06	0.00	.06	1.	1.02	15.30	237	1.35	1.32	.03	1475.
1.01	15.30	93	.10	0.00	.10	1.	1.02	15.40	238	3.37	3.35	.03	2435.
1.01	15.40	94	.26	.18	.08	36.	1.02	15.50	239	.97	.95	.03	3759.
1.01	15.50	95	.07	.05	.03	120.	1.02	16.00	240	.60	.57	.03	3943.
1.01	16.00	96	.05	.02	.03	157.	1.02	16.10	241	.46	.43	.03	3181.
1.01	16.10	97	.03	.01	.03	134.	1.02	16.20	242	.46	.43	.03	2282.
1.01	16.20	98	.03	.01	.03	89.	1.02	16.30	243	.46	.43	.03	1754.
1.01	16.30	99	.03	.01	.03	61.	1.02	16.40	244	.46	.43	.03	1449.

1.01	16.40	100	.03	.01	.03	45.	1.02	16.50	245	.46	.43	.03	1286.
1.01	16.50	101	.03	.01	.03	36.	1.02	17.00	246	.46	.43	.03	1199.
1.01	17.00	102	.03	.01	.03	32.	1.02	17.10	247	.36	.34	.03	1132.
1.01	17.10	103	.03	.00	.03	28.	1.02	17.20	248	.36	.34	.03	1046.
1.01	17.20	104	.03	.00	.03	22.	1.02	17.30	249	.36	.34	.03	963.
1.01	17.30	105	.03	.00	.03	16.	1.02	17.40	250	.36	.34	.03	905.
1.01	17.40	106	.03	.00	.03	12.	1.02	17.50	251	.36	.34	.03	877.
1.01	17.50	107	.03	.00	.03	10.	1.02	18.00	252	.36	.34	.03	863.
1.01	18.00	108	.03	.00	.03	8.	1.02	18.10	253	.03	.00	.03	789.
1.01	18.10	109	.00	0.00	.00	7.	1.02	18.20	254	.03	.00	.03	577.
1.01	18.20	110	.00	0.00	.00	6.	1.02	18.30	255	.03	.00	.03	345.
1.01	18.30	111	.00	0.00	.00	4.	1.02	18.40	256	.03	.00	.03	184.
1.01	18.40	112	.00	0.00	.00	3.	1.02	18.50	257	.03	.00	.03	102.
1.01	18.50	113	.00	0.00	.00	2.	1.02	19.00	258	.03	.00	.03	57.
1.01	19.00	114	.00	0.00	.00	2.	1.02	19.10	259	.03	.00	.03	32.
1.01	19.10	115	.00	0.00	.00	1.	1.02	19.20	260	.03	.00	.03	19.
1.01	19.20	116	.00	0.00	.00	1.	1.02	19.30	261	.03	.00	.03	12.
1.01	19.30	117	.00	0.00	.00	1.	1.02	19.40	262	.03	.00	.03	8.
1.01	19.40	118	.00	0.00	.00	1.	1.02	19.50	263	.03	.00	.03	6.
1.01	19.50	119	.00	0.00	.00	1.	1.02	20.00	264	.03	.00	.03	5.
1.01	20.00	120	.00	0.00	.00	1.	1.02	20.10	265	.03	.00	.03	5.
1.01	20.10	121	.00	0.00	.00	1.	1.02	20.20	266	.03	.00	.03	5.
1.01	20.20	122	.00	0.00	.00	1.	1.02	20.30	267	.03	.00	.03	5.
1.01	20.30	123	.00	0.00	.00	1.	1.02	20.40	268	.03	.00	.03	5.
1.01	20.40	124	.00	0.00	.00	1.	1.02	20.50	269	.03	.00	.03	5.
1.01	20.50	125	.00	0.00	.00	1.	1.02	21.00	270	.03	.00	.03	5.
1.01	21.00	126	.00	0.00	.00	1.	1.02	21.10	271	.03	.00	.03	5.
1.01	21.10	127	.00	0.00	.00	1.	1.02	21.20	272	.03	.00	.03	5.
1.01	21.20	128	.00	0.00	.00	1.	1.02	21.30	273	.03	.00	.03	5.
1.01	21.30	129	.00	0.00	.00	1.	1.02	21.40	274	.03	.00	.03	5.
1.01	21.40	130	.00	0.00	.00	1.	1.02	21.50	275	.03	.00	.03	5.
1.01	21.50	131	.00	0.00	.00	1.	1.02	22.00	276	.03	.00	.03	5.
1.01	22.00	132	.00	0.00	.00	1.	1.02	22.10	277	.03	.00	.03	5.
1.01	22.10	133	.00	0.00	.00	1.	1.02	22.20	278	.03	.00	.03	5.
1.01	22.20	134	.00	0.00	.00	1.	1.02	22.30	279	.03	.00	.03	5.
1.01	22.30	135	.00	0.00	.00	1.	1.02	22.40	280	.03	.00	.03	5.
1.01	22.40	136	.00	0.00	.00	1.	1.02	22.50	281	.03	.00	.03	5.
1.01	22.50	137	.00	0.00	.00	1.	1.02	23.00	282	.03	.00	.03	5.
1.01	23.00	138	.00	0.00	.00	1.	1.02	23.10	283	.03	.00	.03	5.
1.01	23.10	139	.00	0.00	.00	1.	1.02	23.20	284	.03	.00	.03	5.
1.01	23.20	140	.00	0.00	.00	1.	1.02	23.30	285	.03	.00	.03	5.
1.01	23.30	141	.00	0.00	.00	1.	1.02	23.40	286	.03	.00	.03	5.
1.01	23.40	142	.00	0.00	.00	1.	1.02	23.50	287	.03	.00	.03	5.
1.01	23.50	143	.00	0.00	.00	1.	1.03	0.00	288	.03	.00	.03	5.
1.02	0.00	144	.00	0.00	.00	1.	1.03	.10	289	0.00	0.00	0.00	5.
1.02	.10	145	.02	0.00	.02	1.	1.03	.20	290	0.00	0.00	0.00	4.
									SUM	24.99	20.22	4.77	51193.
										(635.)	(514.)	(121.)	(1449.62)

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME

CFS	3943.	1287.	349.	177.	51228.
CMS	112.	36.	10.	5.	1451.
INCHES		18.42	19.97	20.36	20.36
MM		467.77	507.27	517.27	517.27
AC-FT		638.	692.	706.	706.
THOUS CU M		787.	854.	870.	870.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	18.	60.	78.	67.	45.	31.	23.
18.	16.	14.	11.	8.	6.	5.	4.	4.	3.
2.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
4.	12.	22.	29.	33.	35.	36.	36.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	64.	149.	244.	309.
343.	361.	378.	403.	429.	446.	455.	460.	472.	504.
539.	563.	575.	581.	581.	599.	737.	1218.	1879.	1971.
1591.	1141.	877.	725.	643.	599.	566.	523.	481.	452.
438.	431.	394.	289.	172.	92.	51.	28.	16.	10.
6.	4.	3.	3.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1971.	643.	174.	88.	25614.
CMS	56.	18.	5.	3.	725.
INCHES		9.21	9.99	10.18	10.18
MM		233.88	253.63	258.63	258.63
AC-FT		319.	346.	353.	353.
THOUS CU M		394.	427.	435.	435.

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HYDROGRAPH ROUTING

ROUTING COMPUTATIONS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	-1

STAGE	1096.20	1097.20	1098.40	1098.70	1099.20	1100.20	1101.20	1102.20	1103.20
FLOW	0.00	93.00	303.00	639.00	1675.00	4804.00	8967.00	13970.00	19740.00

SURFACE AREA=	33.	34.	35.	35.	36.	37.	37.	38.
CAPACITY=	0.	33.	67.	102.	138.	174.	211.	249.
ELEVATION=	1096.	1097.	1098.	1099.	1100.	1101.	1102.	1103.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1096.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1098.4	0.0	0.0	0.

STATION 2, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	.10	1	.17	1.	0.	0.	1096.2
1.01	.20	2	.33	1.	0.	0.	1096.2
1.01	.30	3	.50	1.	0.	0.	1096.2
1.01	.40	4	.67	1.	0.	0.	1096.2
1.01	.50	5	.83	1.	0.	0.	1096.2
1.01	1.00	6	1.00	1.	0.	0.	1096.2
1.01	1.10	7	1.17	1.	0.	0.	1096.2
1.01	1.20	8	1.33	1.	0.	0.	1096.2
1.01	1.30	9	1.50	1.	0.	0.	1096.2
1.01	1.40	10	1.67	1.	0.	0.	1096.2
1.01	1.50	11	1.83	1.	0.	0.	1096.2
1.01	2.00	12	2.00	1.	0.	0.	1096.2
1.01	2.10	13	2.17	1.	0.	0.	1096.2

1.01	2.20	14	2.33	1.	0.	0.	1096.2
1.01	2.30	15	2.50	1.	0.	0.	1096.2
1.01	2.40	16	2.67	1.	0.	0.	1096.2
1.01	2.50	17	2.83	1.	0.	0.	1096.2
1.01	3.00	18	3.00	1.	0.	0.	1096.2
1.01	3.10	19	3.17	1.	0.	0.	1096.2
1.01	3.20	20	3.33	1.	0.	0.	1096.2
1.01	3.30	21	3.50	1.	0.	0.	1096.2
1.01	3.40	22	3.67	1.	0.	0.	1096.2
1.01	3.50	23	3.83	1.	0.	0.	1096.2
1.01	4.00	24	4.00	1.	0.	0.	1096.2
1.01	4.10	25	4.17	1.	0.	0.	1096.2
1.01	4.20	26	4.33	1.	0.	0.	1096.2
1.01	4.30	27	4.50	1.	0.	0.	1096.2
1.01	4.40	28	4.67	1.	0.	0.	1096.2
1.01	4.50	29	4.83	1.	0.	0.	1096.2
1.01	5.00	30	5.00	1.	0.	0.	1096.2
1.01	5.10	31	5.17	1.	0.	0.	1096.2
1.01	5.20	32	5.33	1.	0.	0.	1096.2
1.01	5.30	33	5.50	1.	0.	0.	1096.2
1.01	5.40	34	5.67	1.	0.	0.	1096.2
1.01	5.50	35	5.83	1.	0.	0.	1096.2
1.01	6.00	36	6.00	1.	0.	0.	1096.2
1.01	6.10	37	6.17	1.	0.	0.	1096.2
1.01	6.20	38	6.33	1.	1.	0.	1096.2
1.01	6.30	39	6.50	1.	1.	0.	1096.2
1.01	6.40	40	6.67	1.	1.	0.	1096.2
1.01	6.50	41	6.83	1.	1.	0.	1096.2
1.01	7.00	42	7.00	1.	1.	0.	1096.2
1.01	7.10	43	7.17	1.	1.	0.	1096.2
1.01	7.20	44	7.33	1.	1.	0.	1096.2
1.01	7.30	45	7.50	1.	1.	0.	1096.2
1.01	7.40	46	7.67	1.	1.	0.	1096.2
1.01	7.50	47	7.83	1.	1.	0.	1096.2
1.01	8.00	48	8.00	1.	1.	0.	1096.2
1.01	8.10	49	8.17	1.	1.	0.	1096.2
1.01	8.20	50	8.33	1.	1.	0.	1096.2
1.01	8.30	51	8.50	1.	1.	0.	1096.2
1.01	8.40	52	8.67	1.	1.	0.	1096.2
1.01	8.50	53	8.83	1.	1.	0.	1096.2
1.01	9.00	54	9.00	1.	1.	0.	1096.2
1.01	9.10	55	9.17	1.	1.	0.	1096.2
1.01	9.20	56	9.33	1.	1.	0.	1096.2
1.01	9.30	57	9.50	1.	1.	0.	1096.2
1.01	9.40	58	9.67	1.	1.	0.	1096.2
1.01	9.50	59	9.83	1.	1.	0.	1096.2
1.01	10.00	60	10.00	1.	1.	0.	1096.2
1.01	10.10	61	10.17	1.	1.	0.	1096.2
1.01	10.20	62	10.33	1.	1.	0.	1096.2
1.01	10.30	63	10.50	1.	1.	0.	1096.2
1.01	10.40	64	10.67	1.	1.	0.	1096.2

1.01	10.50	65	10.83	1.	1.	0.	1096.2
1.01	11.00	66	11.00	1.	1.	0.	1096.2
1.01	11.10	67	11.17	1.	1.	0.	1096.2
1.01	11.20	68	11.33	1.	1.	0.	1096.2
1.01	11.30	69	11.50	1.	1.	0.	1096.2
1.01	11.40	70	11.67	1.	1.	0.	1096.2
1.01	11.50	71	11.83	1.	1.	0.	1096.2
1.01	12.00	72	12.00	1.	1.	0.	1096.2
1.01	12.10	73	12.17	1.	1.	0.	1096.2
1.01	12.20	74	12.33	1.	1.	0.	1096.2
1.01	12.30	75	12.50	1.	1.	0.	1096.2
1.01	12.40	76	12.67	1.	1.	0.	1096.2
1.01	12.50	77	12.83	1.	1.	0.	1096.2
1.01	13.00	78	13.00	1.	1.	0.	1096.2
1.01	13.10	79	13.17	1.	1.	0.	1096.2
1.01	13.20	80	13.33	1.	1.	0.	1096.2
1.01	13.30	81	13.50	1.	1.	0.	1096.2
1.01	13.40	82	13.67	1.	1.	0.	1096.2
1.01	13.50	83	13.83	1.	1.	0.	1096.2
1.01	14.00	84	14.00	1.	1.	0.	1096.2
1.01	14.10	85	14.17	1.	1.	0.	1096.2
1.01	14.20	86	14.33	1.	1.	0.	1096.2
1.01	14.30	87	14.50	1.	1.	0.	1096.2
1.01	14.40	88	14.67	1.	1.	0.	1096.2
1.01	14.50	89	14.83	1.	1.	0.	1096.2
1.01	15.00	90	15.00	1.	1.	0.	1096.2
1.01	15.10	91	15.17	1.	1.	0.	1096.2
1.01	15.20	92	15.33	1.	1.	0.	1096.2
1.01	15.30	93	15.50	1.	1.	0.	1096.2
1.01	15.40	94	15.67	18.	1.	0.	1096.2
1.01	15.50	95	15.83	60.	2.	1.	1096.2
1.01	16.00	96	16.00	78.	5.	2.	1096.3
1.01	16.10	97	16.17	67.	8.	3.	1096.3
1.01	16.20	98	16.33	45.	9.	3.	1096.3
1.01	16.30	99	16.50	31.	10.	4.	1096.3
1.01	16.40	100	16.67	23.	11.	4.	1096.3
1.01	16.50	101	16.83	18.	11.	4.	1096.3
1.01	17.00	102	17.00	16.	12.	4.	1096.3
1.01	17.10	103	17.17	14.	12.	4.	1096.3
1.01	17.20	104	17.33	11.	12.	4.	1096.3
1.01	17.30	105	17.50	8.	12.	4.	1096.3
1.01	17.40	106	17.67	6.	11.	4.	1096.3
1.01	17.50	107	17.83	5.	11.	4.	1096.3
1.01	18.00	108	18.00	4.	11.	4.	1096.3
1.01	18.10	109	18.17	4.	11.	4.	1096.3
1.01	18.20	110	18.33	3.	10.	4.	1096.3
1.01	18.30	111	18.50	2.	10.	4.	1096.3
1.01	18.40	112	18.67	1.	10.	3.	1096.3
1.01	18.50	113	18.83	1.	9.	3.	1096.3
1.01	19.00	114	19.00	1.	9.	3.	1096.3
1.01	19.10	115	19.17	1.	9.	3.	1096.3

1.01	19.20	116	19.33	1.	9.	3.	1096.3
1.01	19.30	117	19.50	1.	8.	3.	1096.3
1.01	19.40	118	19.67	1.	8.	3.	1096.3
1.01	19.50	119	19.83	1.	8.	3.	1096.3
1.01	20.00	120	20.00	1.	7.	3.	1096.3
1.01	20.10	121	20.17	1.	7.	3.	1096.3
1.01	20.20	122	20.33	1.	7.	2.	1096.3
1.01	20.30	123	20.50	1.	7.	2.	1096.3
1.01	20.40	124	20.67	1.	6.	2.	1096.3
1.01	20.50	125	20.83	1.	6.	2.	1096.3
1.01	21.00	126	21.00	1.	6.	2.	1096.3
1.01	21.10	127	21.17	1.	6.	2.	1096.3
1.01	21.20	128	21.33	1.	6.	2.	1096.3
1.01	21.30	129	21.50	1.	5.	2.	1096.3
1.01	21.40	130	21.67	1.	5.	2.	1096.3
1.01	21.50	131	21.83	1.	5.	2.	1096.3
1.01	22.00	132	22.00	1.	5.	2.	1096.3
1.01	22.10	133	22.17	1.	5.	2.	1096.3
1.01	22.20	134	22.33	1.	5.	2.	1096.2
1.01	22.30	135	22.50	1.	4.	2.	1096.2
1.01	22.40	136	22.67	1.	4.	2.	1096.2
1.01	22.50	137	22.83	1.	4.	1.	1096.2
1.01	23.00	138	23.00	1.	4.	1.	1096.2
1.01	23.10	139	23.17	1.	4.	1.	1096.2
1.01	23.20	140	23.33	1.	4.	1.	1096.2
1.01	23.30	141	23.50	1.	4.	1.	1096.2
1.01	23.40	142	23.67	1.	4.	1.	1096.2
1.01	23.50	143	23.83	1.	3.	1.	1096.2
1.02	0.00	144	24.00	1.	3.	1.	1096.2
1.02	.10	145	24.17	1.	3.	1.	1096.2
1.02	.20	146	24.33	1.	3.	1.	1096.2
1.02	.30	147	24.50	1.	3.	1.	1096.2
1.02	.40	148	24.67	1.	3.	1.	1096.2
1.02	.50	149	24.83	1.	3.	1.	1096.2
1.02	1.00	150	25.00	1.	3.	1.	1096.2
1.02	1.10	151	25.17	1.	3.	1.	1096.2
1.02	1.20	152	25.33	1.	3.	1.	1096.2
1.02	1.30	153	25.50	1.	3.	1.	1096.2
1.02	1.40	154	25.67	1.	2.	1.	1096.2
1.02	1.50	155	25.83	1.	2.	1.	1096.2
1.02	2.00	156	26.00	1.	2.	1.	1096.2
1.02	2.10	157	26.17	1.	2.	1.	1096.2
1.02	2.20	158	26.33	1.	2.	1.	1096.2
1.02	2.30	159	26.50	1.	2.	1.	1096.2
1.02	2.40	160	26.67	1.	2.	1.	1096.2
1.02	2.50	161	26.83	1.	2.	1.	1096.2
1.02	3.00	162	27.00	1.	2.	1.	1096.2
1.02	3.10	163	27.17	1.	2.	1.	1096.2
1.02	3.20	164	27.33	1.	2.	1.	1096.2
1.02	3.30	165	27.50	1.	2.	1.	1096.2
1.02	3.40	166	27.67	1.	2.	1.	1096.2

1.02	3.50	167	27.83	1.	2.	1.	1096.2
1.02	4.00	168	28.00	1.	2.	1.	1096.2
1.02	4.10	169	28.17	1.	2.	1.	1096.2
1.02	4.20	170	28.33	1.	2.	1.	1096.2
1.02	4.30	171	28.50	1.	2.	1.	1096.2
1.02	4.40	172	28.67	1.	2.	1.	1096.2
1.02	4.50	173	28.83	1.	2.	1.	1096.2
1.02	5.00	174	29.00	1.	1.	1.	1096.2
1.02	5.10	175	29.17	1.	1.	1.	1096.2
1.02	5.20	176	29.33	1.	1.	1.	1096.2
1.02	5.30	177	29.50	1.	1.	0.	1096.2
1.02	5.40	178	29.67	1.	1.	0.	1096.2
1.02	5.50	179	29.83	1.	1.	0.	1096.2
1.02	6.00	180	30.00	1.	1.	0.	1096.2
1.02	6.10	181	30.17	4.	1.	0.	1096.2
1.02	6.20	182	30.33	12.	2.	1.	1096.2
1.02	6.30	183	30.50	22.	2.	1.	1096.2
1.02	6.40	184	30.67	29.	3.	1.	1096.2
1.02	6.50	185	30.83	33.	4.	1.	1096.2
1.02	7.00	186	31.00	35.	5.	2.	1096.3
1.02	7.10	187	31.17	36.	6.	2.	1096.3
1.02	7.20	188	31.33	36.	8.	3.	1096.3
1.02	7.30	189	31.50	37.	9.	3.	1096.3
1.02	7.40	190	31.67	37.	10.	3.	1096.3
1.02	7.50	191	31.83	37.	11.	4.	1096.3
1.02	8.00	192	32.00	37.	12.	4.	1096.3
1.02	8.10	193	32.17	37.	13.	4.	1096.3
1.02	8.20	194	32.33	37.	14.	5.	1096.3
1.02	8.30	195	32.50	37.	14.	5.	1096.4
1.02	8.40	196	32.67	37.	15.	5.	1096.4
1.02	8.50	197	32.83	37.	16.	6.	1096.4
1.02	9.00	198	33.00	37.	17.	6.	1096.4
1.02	9.10	199	33.17	37.	18.	6.	1096.4
1.02	9.20	200	33.33	37.	18.	7.	1096.4
1.02	9.30	201	33.50	37.	19.	7.	1096.4
1.02	9.40	202	33.67	37.	20.	7.	1096.4
1.02	9.50	203	33.83	37.	20.	7.	1096.4
1.02	10.00	204	34.00	37.	21.	7.	1096.4
1.02	10.10	205	34.17	37.	22.	8.	1096.4
1.02	10.20	206	34.33	37.	22.	8.	1096.4
1.02	10.30	207	34.50	37.	23.	8.	1096.4
1.02	10.40	208	34.67	37.	23.	8.	1096.5
1.02	10.50	209	34.83	37.	24.	8.	1096.5
1.02	11.00	210	35.00	37.	24.	9.	1096.5
1.02	11.10	211	35.17	37.	25.	9.	1096.5
1.02	11.20	212	35.33	37.	25.	9.	1096.5
1.02	11.30	213	35.50	37.	26.	9.	1096.5
1.02	11.40	214	35.67	37.	26.	9.	1096.5
1.02	11.50	215	35.83	37.	27.	9.	1096.5
1.02	12.00	216	36.00	37.	27.	10.	1096.5
1.02	12.10	217	36.17	64.	28.	10.	1096.5

1.02	12.10	217	36.17	64.	28.	10.	1096.5
1.02	12.20	218	36.33	149.	31.	11.	1096.5
1.02	12.30	219	36.50	244.	37.	13.	1096.6
1.02	12.40	220	36.67	309.	46.	16.	1096.7
1.02	12.50	221	36.83	343.	57.	20.	1096.8
1.02	13.00	222	37.00	361.	68.	24.	1096.9
1.02	13.10	223	37.17	378.	79.	28.	1097.0
1.02	13.20	224	37.33	403.	91.	32.	1097.2
1.02	13.30	225	37.50	429.	111.	37.	1097.3
1.02	13.40	226	37.67	446.	134.	41.	1097.4
1.02	13.50	227	37.83	455.	155.	45.	1097.6
1.02	14.00	228	38.00	460.	176.	49.	1097.7
1.02	14.10	229	38.17	472.	196.	53.	1097.8
1.02	14.20	230	38.33	504.	216.	57.	1097.9
1.02	14.30	231	38.50	539.	236.	61.	1098.0
1.02	14.40	232	38.67	563.	258.	65.	1098.1
1.02	14.50	233	38.83	575.	279.	70.	1098.3
1.02	15.00	234	39.00	581.	299.	74.	1098.4
1.02	15.10	235	39.17	581.	383.	77.	1098.5
1.02	15.20	236	39.33	599.	458.	79.	1098.5
1.02	15.30	237	39.50	737.	534.	82.	1098.6
1.02	15.40	238	39.67	1218.	729.	86.	1098.7
1.02	15.50	239	39.83	1879.	1204.	94.	1099.0
1.02	16.00	240	40.00	1971.	1621.	101.	1099.2
1.02	16.10	241	40.17	1591.	1725.	103.	1099.2
1.02	16.20	242	40.33	1141.	1506.	99.	1099.1
1.02	16.30	243	40.50	877.	1219.	95.	1099.0
1.02	16.40	244	40.67	725.	977.	90.	1098.9
1.02	16.50	245	40.83	643.	807.	88.	1098.8
1.02	17.00	246	41.00	599.	700.	86.	1098.7
1.02	17.10	247	41.17	566.	635.	85.	1098.7
1.02	17.20	248	41.33	523.	604.	84.	1098.7
1.02	17.30	249	41.50	481.	567.	83.	1098.6
1.02	17.40	250	41.67	452.	532.	81.	1098.6
1.02	17.50	251	41.83	438.	501.	81.	1098.6
1.02	18.00	252	42.00	431.	478.	80.	1098.6
1.02	18.10	253	42.17	394.	455.	79.	1098.5
1.02	18.20	254	42.33	289.	414.	78.	1098.5
1.02	18.30	255	42.50	172.	347.	76.	1098.4
1.02	18.40	256	42.67	92.	297.	73.	1098.4
1.02	18.50	257	42.83	51.	282.	70.	1098.3
1.02	19.00	258	43.00	28.	265.	67.	1098.2
1.02	19.10	259	43.17	16.	249.	64.	1098.1
1.02	19.20	260	43.33	10.	233.	61.	1098.0
1.02	19.30	261	43.50	6.	218.	58.	1097.9
1.02	19.40	262	43.67	4.	203.	55.	1097.8
1.02	19.50	263	43.83	3.	189.	52.	1097.8
1.02	20.00	264	44.00	3.	177.	50.	1097.7
1.02	20.10	265	44.17	2.	165.	47.	1097.6
1.02	20.20	266	44.33	2.	154.	45.	1097.5
1.02	20.30	267	44.50	2.	143.	43.	1097.5

1.02	20.40	268	44.67	2.	134.	41.	1097.4
1.02	20.50	269	44.83	2.	125.	39.	1097.4
1.02	21.00	270	45.00	2.	116.	38.	1097.3
1.02	21.10	271	45.17	2.	108.	36.	1097.3
1.02	21.20	272	45.33	2.	101.	35.	1097.2
1.02	21.30	273	45.50	2.	94.	34.	1097.2
1.02	21.40	274	45.67	2.	90.	32.	1097.2
1.02	21.50	275	45.83	2.	87.	31.	1097.1
1.02	22.00	276	46.00	2.	84.	30.	1097.1
1.02	22.10	277	46.17	2.	81.	29.	1097.1
1.02	22.20	278	46.33	2.	78.	28.	1097.0
1.02	22.30	279	46.50	2.	75.	27.	1097.0
1.02	22.40	280	46.67	2.	72.	26.	1097.0
1.02	22.50	281	46.83	2.	70.	25.	1096.9
1.02	23.00	282	47.00	2.	67.	24.	1096.9
1.02	23.10	283	47.17	2.	65.	23.	1096.9
1.02	23.20	284	47.33	2.	62.	22.	1096.9
1.02	23.30	285	47.50	2.	60.	21.	1096.8
1.02	23.40	286	47.67	2.	58.	21.	1096.8
1.02	23.50	287	47.83	2.	56.	20.	1096.8
1.03	0.00	288	48.00	2.	54.	19.	1096.8
1.03	.10	289	48.17	2.	52.	19.	1096.8
1.03	.20	290	48.33	2.	50.	18.	1096.7

PEAK OUTFLOW IS 1725. AT TIME 40.17 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1725.	555.	166.	84.	24334.
CMS	49.	16.	5.	2.	689.
INCHES		7.95	9.51	9.67	9.67
MM		201.84	241.52	245.71	245.71
AC-FT		275.	329.	335.	335.
THOUS CU M		340.	406.	413.	413.

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1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION STATION AREA PLAN RATIO 1
.50

```
HYDROGRAPH AT          1        .65        1      1971.
                       (       1.68)       (     55.82)(

ROUTED TO              2        .65        1      1725.
                       (       1.68)       (     48.86)(
```

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1096.20	1096.20	1098.40
STORAGE	0.	0.	74.
OUTFLOW	0.	0.	303.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1099.22	.82	103.	1725.	3.50	40.17	0.00

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1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  25 SEP 78
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STOUT2     16:56 JAN 25,'79

1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  25 SEP 78
 **********************************
1                               PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                        RUNOFF HYDROGRAPH AT            1
                                        ROUTE HYDROGRAPH TO             2
                                        END OF NETWORK


1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  25 SEP 78
 **********************************

 RUN  DATE# 79/01/25.
      TIME# 11.38.26.


                                    LAKE STOCKHOLM DAM
                                    $PMF
                                    N.J. DAM INSPECTION

                                                  JOB SPECIFICATION
                        NQ       NHR      NMIN      IDAY       IHR      IMIN     METRC      IPLT      IPRT     NSTAN
                       290         0        10         0         0         0         0         0         4         0
                                                   JOPER       NWT     LROPT     TRACE
                                                       5         0         0         0

                                              MULTI-PLAN ANALYSES TO BE PERFORMED
                                                   NPLAN= 1 NRTIO= 5 LRTIO= 1
                          RTIOS=    .50    .30    .25    .20    .15


               **********          **********          **********          **********          **********

                                                  SUB-AREA RUNOFF COMPUTATION

                      COMPUTE HYDROGRAPH
```

```
              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  1       0       0       0       0       0       1       0       0

                                   HYDROGRAPH DATA
      IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
          1       2     .65    0.00     .65     .80   0.000       0       0       0

                                     PRECIP DATA
               SPFE     PMS      R6     R12     R24     R48     R72     R96
               0.00   22.00  112.00  123.00  132.00  142.00    0.00    0.00

                                      LOSS DATA
     LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
         0    0.00    0.00    1.00    0.00    0.00    1.00    1.00     .15    0.00    0.00

                                UNIT HYDROGRAPH DATA
                           TC=  0.00     LAG=   .36

                                    RECESSION DATA
                   STRTQ=   -2.00    QRCSN=    0.00    RTIOR= 1.00
   0                                END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q

                                                                      SUM  24.99  20.22   4.77   51193.
                                                                         ( 635.)( 514.)( 121.)( 1449.62)


       **********       **********       **********       **********       **********

                                  HYDROGRAPH ROUTING

       ROUTING COMPUTATIONS

              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  2       1       0       0       0       0       1       0       0
                                    ROUTING DATA
          QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
            0.0   0.000    0.00       1       0       0       0               0

              NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                  1       0       0   0.000   0.000   0.000      0.      -1

 STAGE     1096.20    1097.20    1098.40    1098.70    1099.20    1100.20    1101.20    1102.20    1103.20

  FLOW        0.00      93.00     303.00     639.00    1675.00    4804.00    8967.00   13970.00   19740.00

SURFACE AREA=     33.       34.       35.       35.       36.       37.       37.       38.
```

CAPACITY=	0.	33.	67.	102.	138.	174.	211.	249.
ELEVATION=	1096.	1097.	1098.	1099.	1100.	1101.	1102.	1103.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1096.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1098.4	0.0	0.0	0.

PEAK OUTFLOW IS 1725. AT TIME 40.17 HOURS

PEAK OUTFLOW IS 776. AT TIME 40.33 HOURS

PEAK OUTFLOW IS 488. AT TIME 40.50 HOURS

PEAK OUTFLOW IS 276. AT TIME 40.67 HOURS

PEAK OUTFLOW IS 196. AT TIME 40.83 HOURS

********** ********** ********** ********** **********

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .30	RATIO 3 .25	RATIO 4 .20	RATIO 5 .15
HYDROGRAPH AT	1	.65	1	1971.	1183.	986.	789.	591.
	(	1.68)	(	55.82)(	33.49)(	27.91)(	22.33)(	16.75)(
ROUTED TO	2	.65	1	1725.	776.	488.	276.	196.
	(	1.68)	(	48.86)(	21.97)(	13.82)(	7.81)(	5.55)(

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1096.20	1096.20	1098.40
STORAGE	0.	0.	74.
OUTFLOW	0.	0.	303.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1099.22	.82	103.	1725.	3.50	40.17	0.00
.30	1098.77	.37	87.	776.	2.00	40.33	0.00
.25	1098.57	.17	80.	488.	1.33	40.50	0.00
.20	1098.25	0.00	69.	276.	0.00	40.67	0.00
.15	1097.79	0.00	53.	196.	0.00	40.83	0.00

1**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 25 SEP 78
****

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1096.20	1096.20	1098.40
STORAGE	0.	0.	74.
OUTFLOW	0.	0.	303.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1099.22	.82	103.	1725.	3.50	40.17	0.00
.30	1098.77	.37	87.	776.	2.00	40.33	0.00
.25	1098.57	.17	80.	488.	1.33	40.50	0.00
.20	1098.25	0.00	69.	276.	0.00	40.67	0.00
.15	1097.79	0.00	53.	196.	0.00	40.83	0.00

1**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 25 SEP 78
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APPENDIX 4

REFERENCES

LAKE STOCKHOLM DAM

APPENDIX 4

REFERENCES

LAKE STOCKHOLM DAM

1. Memorandum from J.N. Brooks, Hydraulic Engineer to H.T. Critchlow, Chief Div. of Waters, dated 13 September 1928.

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3. Letter from W.H. Boardman to J.N. Brooks, dated 27 September 1928.

4. Letter from J.N. Brooks to W.H. Boardman, dated 17 September 1928.

5. Letter from H.T. Critchlow to W.L. McCue Esq., dated 28 September 1928.

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